

DOCUMENT RESUME

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INSTITUTION Sanford - Lee County Schools, N.C.

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ABSTRACT

The set of six units is designed for use with an instructor in basic technical drafting and is also keyed to other texts. Each unit contains several task packages specifying prerequisites, rationale for learning, objectives, learning activities to be supervised by the instructor, and learning practice. The units cover: pictorial drawing; screw threads and fasteners; cams and gears; surface developments; drawing bar, line, and pie charts; and working drawings and shop processes. (BP)

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DM-I

UNIT PACKAGE 1: PICTORIAL DRAWING

PREREQUISITES: NONE

RATIONALE:

The world sometimes can be a complicated place. Draftsmen have to produce work that is readily understandable to different people. For people who are not familiar with the principles of orthographic projecting, the draftsman has to construct representations that individuals can understand. A method the draftsman can use is an isometric drawing. The word is derived from Greek and means equal measurement. The isometric view gives the individual a view of three sides of the object with all isometric lines true length. The isometric view is called a pictorial view because it is somewhat of a picture of the object.

The other means of clarifying the view of an object is through the use of oblique drawings. These drawings have their frontal plane parallel to the picture plane and the sides are projected from the frontal at an angle of 30° - 45° .

Successful completion of this unit will give you the necessary skills to fulfill the objectives of the task package and give you the help needed to produce pictorial drawings that are correctly presented.

DM-1

OBJECTIVES:

General:

Upon completion of this unit you will be able to draw pictorial views of objects using the isometric and oblique methods.

Specific:

Upon completion of the task packages for this unit, you will be able to:

1. Demonstrate the principles of isometric projection by drawing accurately an isometric illustration of a cube. Your performance will be evaluated in accordance with the instructor's checklist.
2. Use proper drafting techniques to draw an isometric view of an object with inclined planes. Your performance will be evaluated in accordance with the instructor's checklist.
3. Draw an isometric view of an object with a circular plane. Your performance will be evaluated in accordance with the instructor's checklist.
4. Draw an object in isometric using the reversed and horizontal axes. Your performance will be evaluated in accordance with the instructor's checklist.
5. Use correct drafting techniques to draw an isometric view of an object with curved surfaces. Your performance will be evaluated in accordance with the instructor's checklist.

OBJECTIVES (cont'd):

6. Use correct drafting techniques to draw object measurements and section objects in an isometric illustration. Your performance will be evaluated in accordance with the instructor's checklist.
7. Draw an oblique illustration of a block. Your performance will be evaluated in accordance with the instructor's checklist.
8. Use correct drafting techniques to draw an oblique view of an object with circular planes. Your performance will be evaluated in accordance with the instructor's checklist.
9. Use correct drafting techniques to draw an oblique view of an object with angles and inclined surfaces. Your performance will be evaluated in accordance with the instructor's checklist.
10. Draw an oblique view of an object using the cabinet method. Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

In order to complete this unit successfully you should begin your work on Task Package 1, and then as a suggestion proceed to complete each task package in order until you have finished each package in this unit. In the packages you will be asked to view a sound-slide presentation, read and answer questions, and perform some practical exercises. The number and names of the task packages included in this unit are as follows:

LEARNING ACTIVITIES (continued):

- TASK PACKAGE 1: DRAWING ISOMETRIC CUBES
- TASK PACKAGE 2: ISOMETRIC VIEW OF OBJECT WITH INCLINED PLANES
- TASK PACKAGE 3: CIRCULAR PLANES IN ISOMETRIC DRAWING
- TASK PACKAGE 4: REVERSED AXIS OF ISOMETRIC DRAWING
- TASK PACKAGE 5: CURVED PLANES IN ISOMETRIC DRAWING
- TASK PACKAGE 6: DRAWING OBJECT MEASUREMENT IN ISOMETRIC
- TASK PACKAGE 7: DRAWING OBLIQUE CUBES
- TASK PACKAGE 8: DRAWING OBLIQUE VIEWS WITH CIRCULAR PLANES
- TASK PACKAGE 9: DRAWING OBLIQUE VIEWS WITH ANGULAR AND
INCLINED PLANES
- TASK PACKAGE 10: DRAWING AN OBLIQUE OBJECT USING CABINET
METHOD

If you should feel confident enough to pass a comprehensive test at this time, contact your instructor. However, should you feel you are not ready to be tested, begin your work as outlined above.

DM-I-1

UNIT 1: PICTORIAL DRAWING

TASK PACKAGE 1: DRAWING ISOMETRIC CUBE

PREREQUISITES: NONE

RATIONALE:

Pictorial drawing was practiced as early as the days of the cave men. Their caves were decorated with drawings of animals and other objects. It is obvious, then, that this type of drawing in its simplified form has a long history.

Pictorial drawing, as the name implies, is the drawing of pictures. It is another graphical method of shape description used quite generally by architects, draftsmen and engineers; but, unlike the orthographic projection drawings, which can be understood only by such especially trained persons, it can be readily understood by the untrained. In pictorial drawing, one well selected view in the form of a picture is usually sufficient, while, as we have seen, in orthographic projection drawing, it is necessary to draw two, three, and sometimes four views of an object to complete its description. One of the simplest, most generally used, and consequently for us the most important, of these pictorial methods is isometric drawing.

OBJECTIVE:

Upon completion of this task package you will be able to demonstrate the principles of isometric projection by drawing accurately an isometric illustration of a cube. Your performance will be evaluated in accordance with the instructor's check list.

LEARNING ACTIVITY:

1. Read section 14.1 - 14.5 on pages 193 - 196 in Mechanical Drawing, by French and Svenson.
2. Read pages 261 - 264 in Basic Technical Drawing, by Spencer.
3. Review sound-slide presentation DM-I-1 and filmstrip FS-665621.
4. What is a pictorial drawing? Write your answer. _____

5. Study figure 560 on page 262 in Basic Technical Drawing.
6. Approximately how many degrees are there between the horizontal plane and the base of the object in figure 560?

7. Study Figure 14-3a on page 195 in Mechanical Drawing.
8. In block A of figure 14-3a you will notice the letters T L

LEARNING ACTIVITY (cont'd):

on the side of the cube. This is a symbol for true length.

These lines are true length. The lines are actually the same length as they are in orthographic projection.

9. Study figures 14-4 and 14-5b on page 196 in Mechanical Drawing.
10. Notice how the two views in orthographic projection supply all the dimensions for the isometric view.
11. All the lines in the isometric views of 14-4 and 14-5b are "true length."
12. What is the first rule of isometric drawing? _____

13. What is the second rule of isometric drawing? _____

14. The second rule is very important. If when doing an isometric view you become confused, always go back to the second rule.
15. Can you believe it! You've done your first Learning Activity.
Give your answers to your instructor.

LEARNING PRACTICE:

DIRECTIONS: Always read the entire Learning Practice before starting to work. This may help clear up any misunderstanding of directions that you may encounter.

1. The instructor will provide you with all the drawing paper.

LEARNING PRACTICE (cont'd):

you'll need unless you have to draw on an attached sheet in the Learning Practice.

2. The instructor will also provide you with the type of layout to use on your paper. He will give the layout to you at the start of each Learning Practice.
3. Draw an isometric cube.
 - a. Study the cube on page 5 in this task package.
 - b. Draw an isometric view of the cube in the space provided.
 - c. When you have finished your work take it to the instructor for evaluation.
4. The success of completing these packages is entirely up to you, but there's no doubt in our minds that you can succeed.
"Remember every long journey begins with just one step."



Draw an isometric
view of the cube



DM-1-2

UNIT 1: PICTORIAL DRAWING

TASK PACKAGE 2: ISOMETRIC VIEW OF OBJECT WITH INCLINED PLANES.

PREREQUISITES: UNIT 1, TASK PACKAGE 1

RATIONALE:

Don't be shortighted. Be foresighted. If you're foresighted and not shortighted, you'll study the foreshortening of lines.

A line set at an angle to the plane of projection will usually be foreshortened in an isometric view. The draftsman has to use points on the line parallel to the projection plane to obtain an accurate measurement of a foreshortened line. These lines appear as angles in orthographic projection and must be carefully drawn in the isometric view. The proper technique of angular lines in isometric drawings adds realism to the pictorial presentation of the drawing.

OBJECTIVE:

Upon completion of this task package you will be able to draw an isometric view of an object with inclined planes. Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

1. Read page 264 in Basic Technical Drawing.
2. Read pages 197 - 198 in Mechanical Drawing.
3. Review the sound-slide presentation DM-I-2.
4. Study figure 14-6c on page 197 in Mechanical Drawing.
5. Line A B in figure 14-6c is called what kind of line in reference to isometric drawings? _____
6. What are non-isometric lines? _____
7. Study figure 14-6a on page 197 in Mechanical Drawing.
8. Notice that lines D A and E C are not true length lines when viewed in isometric.
9. What other two lines in figure 14-6a are not true length?

10. Study figure 14-6d on page 198 in Mechanical Drawing.
11. How is the apex of the tower found in figure 14-6d? _____

12. Study figure 565 on page 264 in Basic Technical Drawing.
13. How is measurement X found in figure 565? _____

14. Remember: Lines that are parallel on the object itself will be parallel in isometric.
15. Study figure 364 on page 264 in Basic Technical Drawing.

LEARNING ACTIVITY (cont'd):

16. Notice how the inclined lines in figure 564 are measured on the parallel or isometric lines.
17. Drafting could be your thing. Take your answers to the instructor.

LEARNING PRACTICE:

DIRECTION: Read the entire Learning Practice before starting to work.

1. Obtain two sheets of paper from your instructor.
2. Draw an isometric view of the stirrup.
 - a. Prepare your paper using the layout shown in figure 26-3b on page 399 in Mechanical Drawing.
 - b. Place a vertical division line 9" from the left border.
 - c. Study the stirrup, problem 14.36, on page 513 in Mechanical Drawing.
 - d. Draw three orthographic views of the stirrup in the space on the left side of the sheet.
 - e. Dimension the three views using the correct techniques.
 - f. In the space on the right of your paper draw an isometric view of the stirrup, using the starting dimensions as shown in the problem.
 - g. Do not dimension the isometric drawing.
3. Draw an isometric view of the brace.

LEARNING PRACTICE (cont'd):

- a. Prepare your paper using the same layout used in the last problem.
 - b. Place a vertical division line 9" from the right border.
 - c. Study the brace, problem 14.37, on page 513 in Mechanical Drawing.
 - d. Draw three views of the brace using orthographic projection in the space on the right side of the sheet.
 - e. Dimension the three views using correct techniques.
 - f. In the space on the left of your paper draw an isometric view of the brace using the starting dimensions as shown in the problem.
 - g. Do not dimension the isometric view.
4. Finishing a task package is the real thing! Congratulations!
- Take your work to the instructor for evaluation.

DM-1-3

UNIT 1: PICTORIAL DRAWING

TASK PACKAGE 3: CIRCULAR PLANES IN ISOMETRIC DRAWING

PREREQUISITES: UNIT 1, TASK PACKAGES 1 & 2

RATIONALE:

Don't let anything eclipse your attention to the ellipse. It is a valuable construction figure for the draftsman. As you study this task package, you will see how the isometric ellipse will help you convey your design ideas.

Quite often in the construction of isometric drawings it will be necessary to construct ellipses of circles to represent rounded corners or holes on the object. By adding the dimension of depth, the isometric ellipse can be used to represent either a shaft or a hole. A draftsman needs to master the skill associated with isometric drawing. The ability to see the correct plane of the isometric cube helps create a realistic drawing. "Don't be led in circles. Complete this task package."

OBJECTIVE:

Upon completion of this task package you will be able to draw an isometric view of an object that has circular surfaces. Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

1. Read pages 198 and 199 in Mechanical Drawing.
2. Read pages 266-268 in Basic Technical Drawing.
3. Review the sound-slide presentation DM-I-3.
4. Study figure 14-7a on page 198 in Mechanical Drawing.
5. This method of drawing circles in isometric is called the four center method.
6. Study figure 14-7b on page 198 in Mechanical Drawing.
7. Look at pictures b and c in figure 14-7b.
8. Study figure 14-7c on page 199 in Mechanical Drawing.
9. All the arcs in the figure are done using the same techniques shown in figure 17-7a.
10. Study figure 14-7d on page 199 in Mechanical Drawing.
11. Look carefully at pictures b and c in figure 14-7d.
12. Notice the placement of the center points used to draw the arcs.
13. Study figure 59E on page 266 in Basic Technical Drawing.

LEARNING ACTIVITY (cont'd):

14. Notice that even in drawing a circle in isometric we have used the basic isometric block. Remember that second rule.
15. Study figure 569 on page 266 in Basic Technical Drawing.
16. Look at picture a in figure 569.
17. Notice the way each ellipse is shaped on the three sides of the block that we see. Remember this relationship of a cube and its sides.
18. Look at figure 570 on page 267 in Basic Technical Drawing.
19. Study carefully picture b in figure 570.
20. The same four center method is used in picture b, figure 570.
21. Man, this was a long Learning Activity, but I think you have the "hole" thing now. *Figure 570*

LEARNING PRACTICE:

DIRECTIONS: Read the entire Learning Practice before starting to work.

1. Obtain three sheets of paper from your instructor.
2. Draw an isometric cube with an isometric circle on each visible face.
 - a. Prepare your paper using the layout "C".
 - b. Study problem 14.40 on page 514 in Mechanical Drawing.
 - c. Draw the isometric cube with an isometric circle on each visible face as shown in the illustration on page 514, problem 14.40.
 - d. Do not dimension the cube.

LEARNING PRACTICE (cont'd):

3. Draw a cylinder resting on a square base.
 - a. Prepare your paper using layout "C".
 - b. Study problem 14.41 on page 514.
 - c. Draw an isometric view of the cylinder on a square base as shown in the illustration in problem 14.41, starting your drawing $1/4"$ above the title block.
 - d. Do not dimension the problem.
4. Draw an isometric view of the hung bearing.
 - a. Prepare a sheet of paper using the layout as shown in figure 26-3b on page 399 in Mechanical Drawing.
 - b. Place a vertical division line 9" from the left border.
 - c. Study the hung bearing, problem 14.42, on page 514 in Mechanical Drawing.
 - d. Draw three orthographic views of the hung bearing in the space on the left side of the sheet. Don't forget to space the views properly.
 - e. Dimension the three views of the hung bearing.
 - f. Draw an isometric view of the hung bearing in the space on the right side of the sheet.
 - g. Do not dimension the isometric view.
5. You're coming on strong!! Take your work to the instructor so that he can evaluate it.

Finishing a job is never having to say "I quit."

DM-I-4

UNIT 1: PICTORIAL DRAWING

TASK PACKAGE 4: REVERSED AXIS OF ISOMETRIC DRAWING

PREREQUISITES: UNIT 1, TASK PACKAGES 1-3

RATIONALE:

It may be desirable for a draftsman to show the underside of an object in an isometric drawing. The draftsman uses the reversed axis to present a better idea of the object. He may even use a long horizontal axis if the object is long and has various details on it. The principles of construction are the same in all cases. Realism is one of the key words when drawing in isometrics. "Don't be revolved; stick to your thoughts and finish this task package."

OBJECTIVE:

Upon completion of this task package you will be able to draw an object in isometrics using the reversed and horizontal axis. Your performance will be evaluated in accordance with the instructor's check list.

LEARNING ACTIVITY:

1. Read pages 201 -202 in Mechanical Drawing.
2. Read pages 265 - 266 in Basic Technical Drawing.
3. Study figure 567 on page 265 in Basic Technical Drawing.
4. Notice the difference in views of b and c in figure 567.
5. Which view gives more information about the object? _____

6. What is the reversed axis in isometric drawing? _____

7. Study figure 14-12 on page 201 in Mechanical Drawing.
8. Notice the lines ab and bc in pictures 1 and 3 of figure 14-12.
9. Picture 3 in figure 14-12 is what type of isometric view? _____

10. Study figure 14-13 in Mechanical Drawing.
11. The long horizontal axis does not pose a problem, does it?
"We just remember the isometric cube."
12. Success! Success! You just never quit. But that's great.
Turn in your answers to the instructor.

LEARNING PRACTICE:

DIRECTIONS: Read the entire Learning Practice before you start to work.

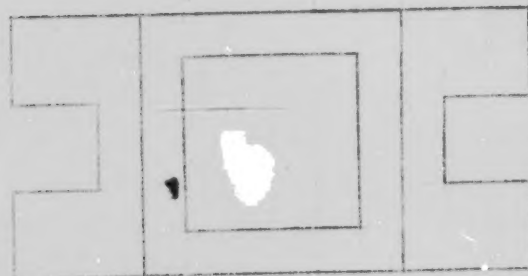
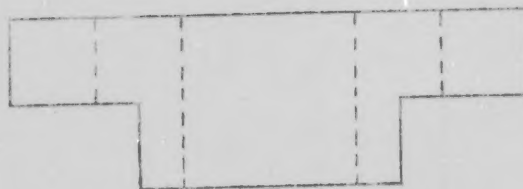
LEARNING PRACTICE (cont'd):

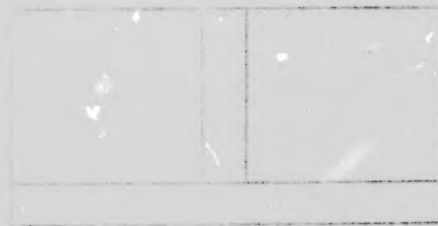
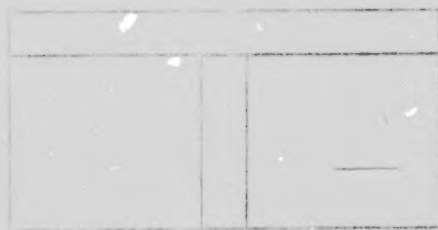
1. Obtain two sheets of paper from your instructor. He will also specify the type layout to use on your paper.
2. Draw the bracket using reversed axis.
 - a. Prepare your paper using the layout as shown in figure 26-3b on page 399 in Mechanical Drawing.
 - b. Place a vertical division line 9" from the left border.
 - c. Study the bracket, problem 14-53 on page 517.
 - d. Draw three views of the bracket using orthographic projection, using the space on the left side of the sheet.
 - e. Dimension the three views using correct techniques.
 - f. Draw on the right of your paper an isometric view of the bracket using the reversed axis.
 - g. Do not dimension the isometric view.
3. Draw the special rod using a long horizontal axis.
 - a. Prepare your paper using the layout as shown in figure 26-3b on page 399 in Mechanical Drawing.
 - b. Study the special rod, problem 14-56, on page 518.
 - c. Draw two views of the special rod, using orthographic projection in the upper half of your paper.
 - d. Dimension the two views using correct techniques.
 - e. Draw the special rod in isometric using the long horizontal axis. Place your view in the lower half of the paper.
 - f. Do not dimension the isometric view.

LEARNING PRACTICE (cont'd):

4. Study the figure on page 5 in the task package.
 - a. Draw in an isometric view of the figure 1 using the space provided to the right of the figure.
 - b. Use the blocks as a form of dimensioning.
5. Could this be magic? You've finished another task package. Be accelerated. Take your work to the instructor for evaluation. You can't afford to loaf if you're gonna earn your bread.

* Should the instructor feel that additional practice is required, he will make additional assignments at this time.





DM-1-5

UNIT 1: PICTORIAL DRAWING

TASK PACKAGE 5: CURVED PLANES IN ISOMETRIC DRAWING

PREREQUISITES: UNIT 1, TASK PACKAGES 1-4

RATIONALE:

This task package is just "plane" curved. That is, you learn the process of curving planes. Now, be careful and see that you take the curves "plane" easy.

You have successfully completed the packages on circles and angles in isometric drawing, and this package will give you an additional skill in developing a pleasing isometric presentation. This package is concerned with curved planes seen in isometric drawings. Some of the same principles that help develop circles in isometric also help to develop curves. The draftsman has to make use of knowledge he gained at some previous time to help coordinate a piece of knowledge he seeks in the future. "Don't throw yourself a curve - complete this task package."

OBJECTIVE:

Upon completion of this task package you will be able to use correct drafting technique to draw an isometric view of an object with curved surfaces. Your performance will be evaluated in accordance with the instructor's check list.

LEARNING ACTIVITY:

A Learning Activity should be like a mini skirt - "Long enough to cover the subject, but short enough to be interesting."

1. Read page 200 in Mechanical Drawing.
2. Read pages 268-269 in Basic Technical Drawing.
3. Study figure 14-9 on page 200 in Mechanical Drawing.
4. Notice how several lines are used in figure 14-9 to project the curve from an orthographic view to an isometric view.
5. Study figure 14-10 on page 200 in Mechanical Drawing.
6. What method is used to draw the circles and arcs in figure 14-10?
7. Study figure 573 on page 268 in Basic Technical Drawing.
8. Notice how the orthographic views are used to plot the curve in the isometric view.
9. No problem will be too great for you if you keep remembering Rule 2.

LEARNING ACTIVITY (cont'd):

10. Take your answer to the instructor and "Keep the faith, baby."

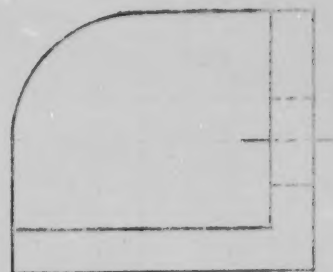
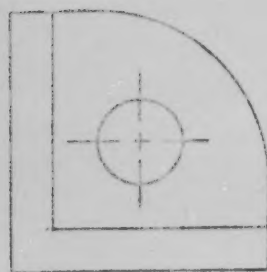
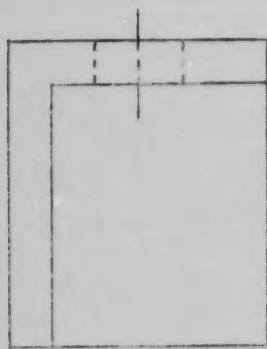
LEARNING PRACTICE:

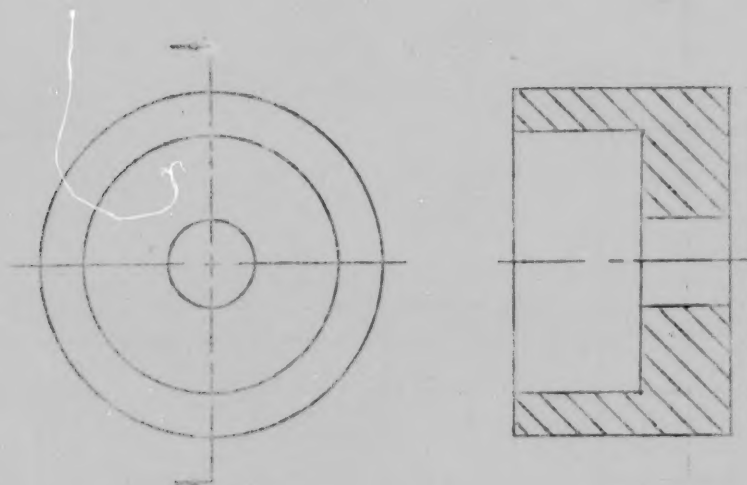
DIRECTIONS: Read the entire Learning Practice before starting to work.

1. Obtain two sheets of paper from your instructor.
2. Draw an isometric view of the lug.
 - a. Prepare your paper using the layout as shown in figure 26-3b on page 399 in Mechanical Drawing.
 - b. Place a vertical division line 9" from the left border.
 - c. Study the lug, problem 14.44 on page 515 in Mechanical Drawing.
 - d. Draw three views of the lug, using orthographic projection, in the space on the left side of the sheet. Dimension these views.
 - e. Draw an isometric view of the lug on the right side of the sheet.
 - f. Do not dimension the isometric view.
3. Draw an isometric view of the bracket.
 - a. Prepare your paper using the same layout as above.
 - b. Study the bracket, problem 14.54 on page 517 in Mechanical Drawing.
 - c. Draw three views of problem 14.54 on page 517 in Mechanical Drawing, using orthographic projection. Dimension the views.
 - d. Draw an isometric view of the bracket. Do not dimension.

LEARNING PRACTICE (cont'd):

4. Study the problem on page 5 in this task package.
 - a. Draw an isometric view of figure 1 on page 5 in the space provided.
 - b. Use the blocks as a form of dimensioning.
 5. So you've breezed through another one. "You must be a cool dude." Take your work to the instructor for evaluation. Nobody makes it like you make it!
- * Should the instructor feel that additional practice is required, he will make additional assignments at this time.





DM-I-6

UNIT 1: PICTORIAL DRAWING

TASK PACKAGE 6: DRAWING OFFSET MEASUREMENT IN ISOMETRIC

PREREQUISITES: UNIT 1, TASK PACKAGES 1 - 5

RATIONALE:

Don't set yourself off from other draftsmen. Learn the techniques of offset measurement. If you learn them well, they will set you off as a superior draftsman.

To complete his ability to develop isometric drawings, the draftsman has to have a knowledge of how to deal with offset measurements in isometrics. This skill is the catch-all for constructing non-isometric lines.

The draftsman may find it convenient to section an isometric drawing in order to clarify some object. As in orthographic projection, the sectional views are shown with either one-half or one-fourth of the object so that the interior construction may be seen. "Don't let this package create an offset with your ability; section the package for success."

OBJECTIVE:

Upon completion of this task package you will be able to use correct drafting technique to draw offset measurements and section objects in an isometric illustration. Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

1. Read pages 265 and 269 in Basic Technical Drawing.
2. Read pages 200 - 201 in Mechanical Drafting.
3. Study figures 14-11a and 14-11b on page 201 in Mechanical Drawing.
4. Notice how, even when you section an object in isometric, you still use the cube principle.
5. What type of section is figure 14-11a? _____

6. What type of section is figure 14-11b? _____

7. Study figure 574 on page 268 in Basic Technical Drawing.
8. Notice the angle the section lines are drawn at in figure 574.
9. Study figure 566 on page 265 in Basic Technical Drawing.

LEARNING ACTIVITY (cont'd):

10. Do we still use our isometric cube in this illustration in figure 566? _____
11. Remember, if you become confused about a line, curve or any other feature on an isometric illustration, always return to Rule Two.
12. Nothing to do but to do it, and you have done it so take your answers to the instructor.

LEARNING PRACTICE:

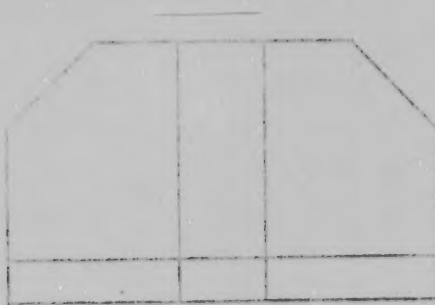
DIRECTIONS: Read the entire Learning Practice before starting to work.

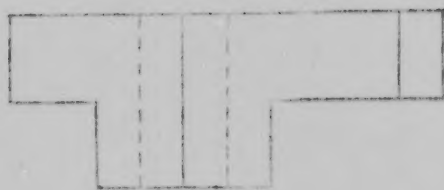
1. Obtain two sheets of paper from your instructor.
2. Draw an isometric view of the bracket.
 - a. Prepare your paper using the layout as shown in figure 26-3b on page 399 in Mechanical Drawing.
 - b. Place a vertical division line 9" from the left border.
 - c. Study the bracket, problem 14.43, on page 515 in Mechanical Drawing.
 - d. Draw three orthographic views of the bracket. Dimension these views.
 - e. Draw an isometric view of the bracket. Do not dimension.
3. Draw an isometric sectioning of the cone bearing.
 - a. Prepare your paper using the layout as shown in figure 26-3b on page 399 in Mechanical Drawing.

LEARNING PRACTICE (cont'd):

- b. Study the cone bearing, problem 14.50, on page 516 in Mechanical Drawing.
 - c. Draw two views of the cone bearing, using orthographic projection on the left half of the paper.
 - d. Draw an isometric half section of the cone bearing on the right half of the paper.
4. Turn to page 5 in this task package and study figure 1.
 - a. Draw an isometric view of figure 1 in the space provided.
 - b. Use the blocks as a unit of measurement.
5. Task package make the world go round. You've finished another one! Take your work to the instructor for an evaluation.

* Should the instructor feel that additional practice is required, he will make additional assignments at this time.





DM-I-7

UNIT 1: PICTORIAL DRAWING

TASK PACKAGE 7: DRAWING OBLIQUE CUBES

PREREQUISITES: UNIT 1, TASK PACKAGES 1 - 6

RATIONALE:

In oblique drawing, as in the other forms of pictorial drawing, three sides of the object are shown in one view. The front surfaces of the object and the surfaces parallel to the front view are shown in their true shape and size, as is the case in orthographic projection. Oblique drawing is another technique employed by the draftsman to further the communication of the graphical language. The oblique illustration serves as a means of projecting the image of an object pictorially. "Your talent will really be unique if you can master this package of drawing in oblique."

OBJECTIVE:

Upon completion of this task package you will be able to draw an oblique illustration of a block. Your performance will be evaluated in accordance with the instructor's check list.

LEARNING ACTIVITY:

1. Read pages 269-271 in Basic Technical Drawing.
2. Read pages 203-204 in Mechanical Drawing.
3. Review slide presentation DM-1-7 as today's feature attraction.
4. Study figure 14-17a on page 203 in Mechanical Drawing.
5. What angle does the object make with the horizontal plane when projected as an oblique figure? _____

6. Study figure 14-18 on page 203 in Mechanical Drawing.
7. What is the basic difference between an isometric and an oblique drawing? _____

8. What is the first rule of oblique drawing? _____

9. What is the second rule of oblique drawing? _____

10. Study figure 575 on page 269 in Basic Technical Drawing.
11. Study figure 576 on page 269 in Basic Technical Drawing.
12. How many orthographic views are used to project the oblique illustration in figure 576? _____

13. Study figure 577 on page 270 in Basic Technical Drawing.

LEARNING ACTIVITY (cont'd):

14. Are all dimensions true length in figure 577? _____

15. Study figure 578 on page 270 in Basic Technical Drawing.
16. Are all shapes lying in the front face, or parallel to it,
true length in oblique drawing? _____

17. Finishing a packet is the real thing. Congratulations! Take
your answers to the instructor.

LEARNING PRACTICE:

DIRECTIONS: Read the entire Learning Practice before starting
to work.

1. Obtain three sheets of paper from your instructor.
2. Draw an oblique block.
 - a. Prepare your paper using layout "C".
 - b. Study the block on page 5 of this task package.
 - c. Draw an oblique view of the block on page 5 in this task
package.
3. Draw figure 1 on page 6.
 - a. Prepare your paper using layout "C".
 - b. Draw two views of figure 1 on page 6 using orthographic
projection.

LEARNING PRACTICE (cont'd):

- c. Dimension the view using the correct technique.
 - d. Draw an oblique view of figure 1 on page 6.
4. Draw figure 2 on page 6.
 - a. Prepare your paper using layout "C".
 - b. Draw two views of figure 2 in orthographic projection.
 - c. Dimension the views using the correct technique.
 - d. Draw an oblique view of figure 2 on page 6.
5. Way to hustle, baby! You've finished another task package.
Take your work to the instructor for evaluation.

ASSIGNMENT: Make a full-size oblique drawing of Figure 1

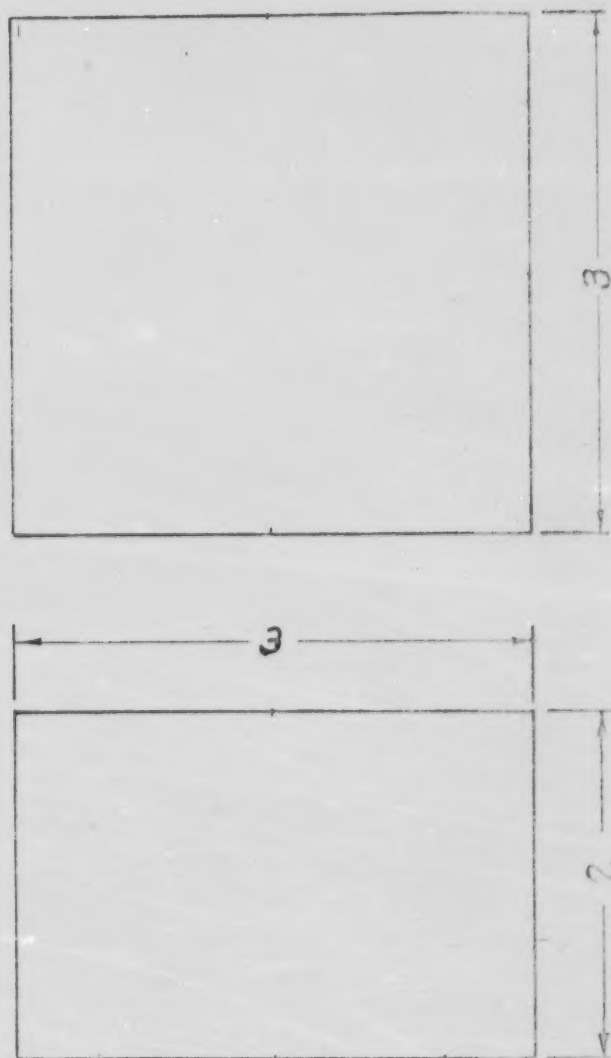


FIG. 1.

MAKE A FULL-SIZE OBLIQUE
DRAWING OF FIG. 1.

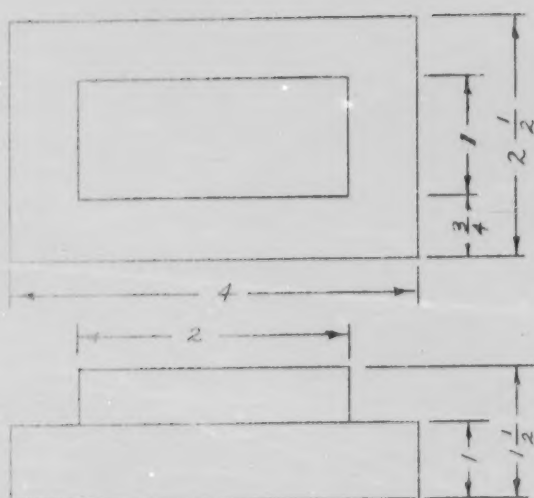


Figure 1

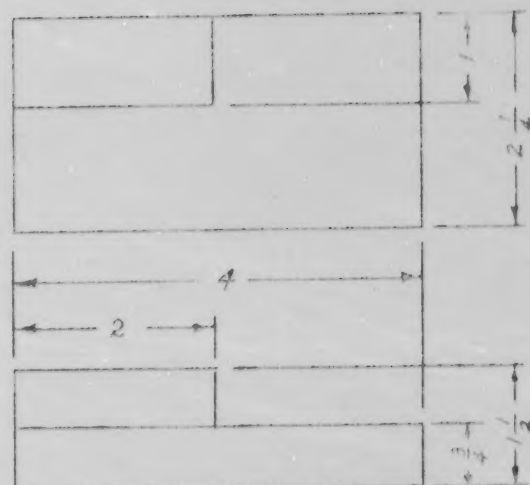


Figure 2

DM-I-8

UNIT 1: PICTORIAL DRAWING

TASK PACKAGE 8: DRAWING OBLIQUE VIEWS WITH CIRCULAR PLANES

PREREQUISITES: UNIT 1, TASK PACKAGES 1-7

RATIONALE:

If you want to be unique, draw your circles oblique, and add to your techniques. You can get creative sparks if you draw the arcs. No kidding, though, these terms and techniques are important to you as a draftsman.

The draftsman has to know how to draw circles and arcs on oblique objects. To maintain a level of understanding, these circles and arcs have to be represented correctly. A draftsman does not want to sow the seeds of misunderstanding, so remember circles will always appear as ellipses or ovals when they are drawn in oblique, similar to those we saw in isometric drawing. We are finding a lot of the processes in drafting are related. "Don't go round in circles; nail these oblique views down."

OBJECTIVE:

Upon completion of this task package you will be able to use correct drafting techniques to draw an oblique view of an object with circular planes. Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

1. Read pages 204 - 206 in Mechanical Drawing.
 2. Read page 273 in Basic Technical Drawing.
 3. Study figure 584 on page 273 in Basic Technical Drawing.
 4. What method is used to draw circles in oblique drawings?
-
5. Study figure 14.20a on page 205 in Mechanical Drawing.
 6. Study figure 14.21a on page 206 in Mechanical Drawing.
 7. Study figure 14.21b on page 206 in Mechanical Drawing.
 8. Notice how all the curved and circular planes of the object are drawn in the oblique illustration.
 9. Remember circles and arcs in an oblique illustration are drawn the same as those in an isometric illustration.
 10. Learning Activity can be fun, especially when you've finished the Learning Activity. Take your answers to the instructor.

LEARNING PRACTICE:

DIRECTIONS: Read the entire Learning Practice before starting to work.

1. Obtain three sheets of paper from your instructor.
2. Draw an oblique view of the crank.
 - a. Prepare your paper using the layout as shown in figure 26-3b on page 399 in Mechanical Drawing.
 - b. Study the crank, problem 14.59, on page 518 in Mechanical Drawing.
 - c. Draw the necessary views of the crank using orthographic projection - using the left half of the sheet.
 - d. Dimension the orthographic views of the crank using correct techniques.
 - e. Draw an oblique view of the crank, problem 14.59, in Mechanical Drawing. Place the axis on a 45° angle with the horizontal plane. Use the right half of the sheet.
 - f. Do not dimension the oblique view.
3. Draw an oblique view of the forked guide.
 - a. Prepare your paper using the layout as above.
 - b. Study problem 14.60, the forked guide, on page 518 in Mechanical Drawing.
 - c. Draw two views of the forked guide using orthographic projection on the left half of your sheet.

LEARNING PRACTICE (cont'd):

- d. Dimension the orthographic view using correct techniques.
- e. Draw an oblique view of the forked guide, problem 14.60, on the right half of your sheet. Place the axis on a 45° angle with the horizontal plane.
- f. Do not dimension the oblique drawing.
4. Draw an oblique view of the guide link.
 - a. Prepare your paper using the layout as shown in figure 26-3b on page 399 in Mechanical Drawing.
 - b. Study the guide link, problem 14.61 on page 518 in Mechanical Drawing.
 - c. Draw the necessary views of the guide link using orthographic projection, on the left half of your sheet.
 - d. Dimension the orthographic views of the guide link using correct techniques.
 - e. Draw an oblique view of the guide link, problem 14.61, on the right half of your sheet. Place the axis on a 30° angle with the horizontal plane.
5. You've come a long way, baby! Go further with the next one, but give this one to the instructor for an evaluation. You're really making the scene! Stay with it!

DM-I-9

UNIT I: PICTORIAL DRAWING

TASK PACKAGE 9: DRAWING OBLIQUE VIEW WITH ANGULAR AND INCLINED PLANES

PREREQUISITES: UNIT I, TASK PACKAGES 1 - 8

RATIONALE:

Are you inclined to know all the angles? If you are, you'll go far as a draftsman. If you are not, you can catch up on such knowledge in this package.

The draftsman will find that oblique views, just as isometrics, contain lines other than circles, arcs, and lines parallel to the frontal plane. A draftsman becomes involved with angular lines in oblique drawing. These lines should present no problem to you. You have succeeded in isometrics; and the oblique projection is a close relative to the isometric. Incorporating this skill along with the others learned in this unit will aid you in drawing realistic pictorials. Let us see if you can "angle in" on the task package.

OBJECTIVE:

Upon completion of this task package you will be able to use correct drafting techniques to draw an oblique view of an object with angles and inclined surfaces. Your performance will be evaluated in accordance with the instructor's check list.

LEARNING ACTIVITY:

1. Read page 204 in Mechanical Drawing.
2. Read pages 272- 273 in Basic Technical Drawing.
3. What is a basic rule for drawing oblique views? _____

4. Study figure 583 on page 273 in Basic Technical Drawing.
5. In figure 583 is any dimension transferred as they are in isometrics? _____

6. Study figure 14-19a on page 204 in Mechanical Drawing.
7. Notice the three different oblique views of the block in figure 14-19a.
8. Study figure 14-19b on page 205 in Mechanical Drawing.
9. The incline lines in the three pictures of figure 14-19b are found using the same technique employed in isometrics.
10. Bad luck often brings good luck. You've had good luck by finishing the Learning Activity. Take your answers to the instructor.

LEARNING PRACTICE:

DIRECTIONS: Read the entire Learning Practice before starting to work.

1. Obtain four sheets of paper from the instructor.
2. Draw an isometric view of the locating plate.
 - a. Prepare your paper using the layout as shown in figure 26-3b on page 399 in Mechanical Drawing.
 - b. Place a vertical division line 9" from the left border.
 - c. Study the locating plate, problem 14.64, on page 519 in Mechanical Drawing.
 - d. Draw three orthographic views of the locating plate.
 - e. Dimension the views of the locating plate using correct techniques.
 - f. Draw a right oblique view of the locating plate using an axis of 45° with the horizontal plane.
 - g. Do not dimension the oblique view.
3. Draw an oblique view of the angle support.
 - a. Prepare your paper, using the layout as above.
 - b. Study the angle support, problem 14.58, on page 518 in Mechanical Drawing.
 - c. Draw the necessary view of the angle support using orthographic procedures, on the left half of your sheet.
 - d. Dimension the orthographic views of the angle support using correct technique.

LEARNING PRACTICE (cont'd):

- e. Draw a right oblique view of the angle support using an axis of 30° with the horizontal plane, on the right half of your sheet.
- f. Do not dimension the oblique view.
- 4. Draw an oblique view of the V-block.
 - a. Prepare your paper using layout "C".
 - b. Follow the instructions at the top of page 289 in Basic Technical Drawing.
 - c. Study the V-block, problem 2, on page 289 in Basic Technical Drawing.
 - d. Draw a right oblique view of the V-block using an axis of 45° with the horizontal plane.
 - e. Do not dimension the oblique view.
- 5. Draw an oblique view of the special cam.
 - a. Prepare your paper using layout "C".
 - b. Follow the instructions on page 289 in Basic Technical Drawing.
 - c. Study the special cam, problem 2, page 290 in Basic Technical Drawing.
 - d. Draw a left oblique view of the special cam using an axis of 45° with the horizontal plane.
 - e. Do not dimension the oblique view.
- 6. Hanging in the groove, are you, dude? Congratulations. Take your work to the instructor so he can evaluate it.

DM-1-10

UNIT I: PICTORIAL DRAWING

TASK PACKAGE 10: DRAWING AN OBLIQUE OBJECT USING CABINET METHOD

PREREQUISITES: UNIT I, TASK PACKAGES 1-9

RATIONALE:

Have you got the oblique cramps yet? Let's hope not. For we are continuing the study of the oblique technique, which, as you probably know by now, is a valuable asset to the draftsman.

Having completed all the task packages to this point, you should have a good skill in the use of oblique drawings. This package will strengthen your new skills by letting you experience a particular type of oblique drawing. The cabinet view is used to give a special visual effect to the oblique drawing. The draftsman can use this skill to further his mastery of pictorial drawings. You will have an opportunity to accomplish the objective of this task package if you do not hide in the "cabinet," and only if you conquer the "cabinet view."

OBJECTIVE:

Upon completion of this task package you will be able to draw an oblique view of an object using the cabinet method. Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

1. Read pages 271-272 in Basic Technical Drawing.
2. Read pages 206-207 in Mechanical Drawing.
3. Where did the term "cabinet view" originate? _____

4. What is a "cabinet view"? _____

5. Study figures 14.23a, 14.23b, 14.23c and 14.23d on page 207 in Mechanical Drawing.
6. Look at the picture in figure 14.23c. What is the depth of the bookcase when drawn as a cabinet view? _____

7. Study figure 580 on page 271 in Basic Technical Drawing.
8. What is the difference between a cavalier and a cabinet drawing? _____

LEARNING ACTIVITY (cont'd):

9. You have this Learning Activity in the bag. Take your answers to the instructor.

LEARNING PRACTICE:

DIRECTIONS: Read the entire Learning Practice before starting to work.

1. Obtain two sheets of paper from your instructor.
2. Draw an oblique cabinet view of the clock case.
 - a. Prepare your paper using the layout as shown in figure 26-3b on page 399 in Mechanical Drawing.
 - b. Study the clock case, problem 14.65, on page 519 in Mechanical Drawing.
 - c. Draw two views of the clock case using orthographic projection on the left half of your sheet, using a scale of $1/2" = 1"$.
 - d. Dimension the orthographic views of the clock case using correct procedures.
 - e. Draw a right oblique cabinet view of the clock case using a 30° axis to the horizontal plane, also using a scale of $1/2" = 1"$.
 - f. Do not dimension the oblique view.
3. Draw an oblique cabinet view of the bracket.
 - a. Prepare your paper using the layout as above.
 - b. Study the bracket, problem 5, on page 387 in Basic Technical Drawing.

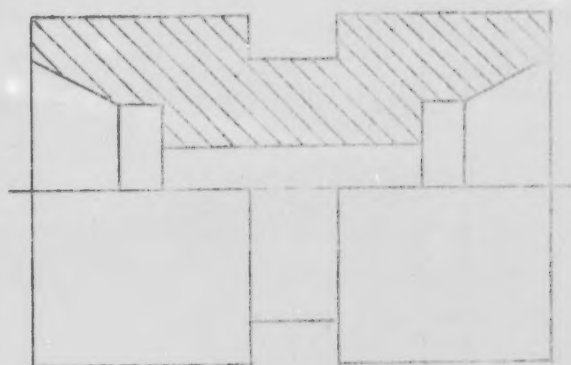
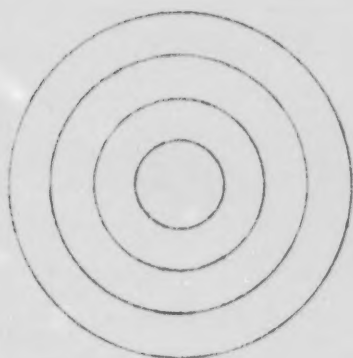
LEARNING PRACTICE (cont'd):

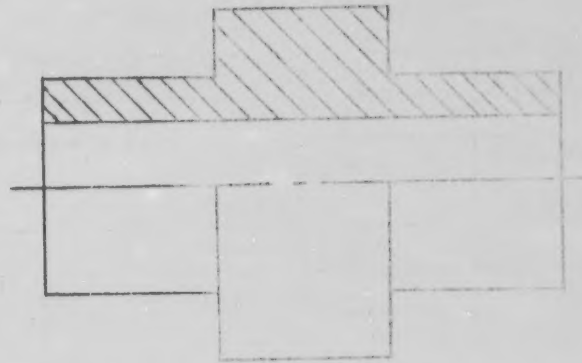
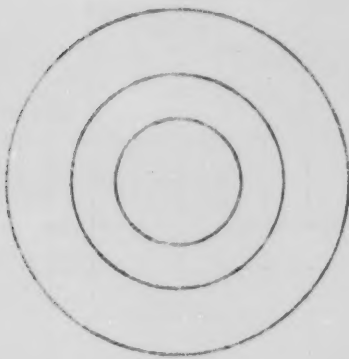
- c. Draw three views of the bracket using orthographic projection, on the left half of your sheet.
- d. Dimension the orthographic view using correct technique.
- e. Draw a left oblique cabinet view of the bracket using a 45° axis to the horizontal plane - on the right half of your sheet.
- f. Do not dimension the oblique view.
- 4. Draw Objects in oblique cabinet view.
 - a. Study the figures on pages 5 and 6 in this task package.
 - b. In the space provided, draw a cabinet view of each figure.
Use the blocks as a means of dimensioning.

Some of us got it and some of us don't. But looks like you have.

Take your work to the instructor for evaluation.

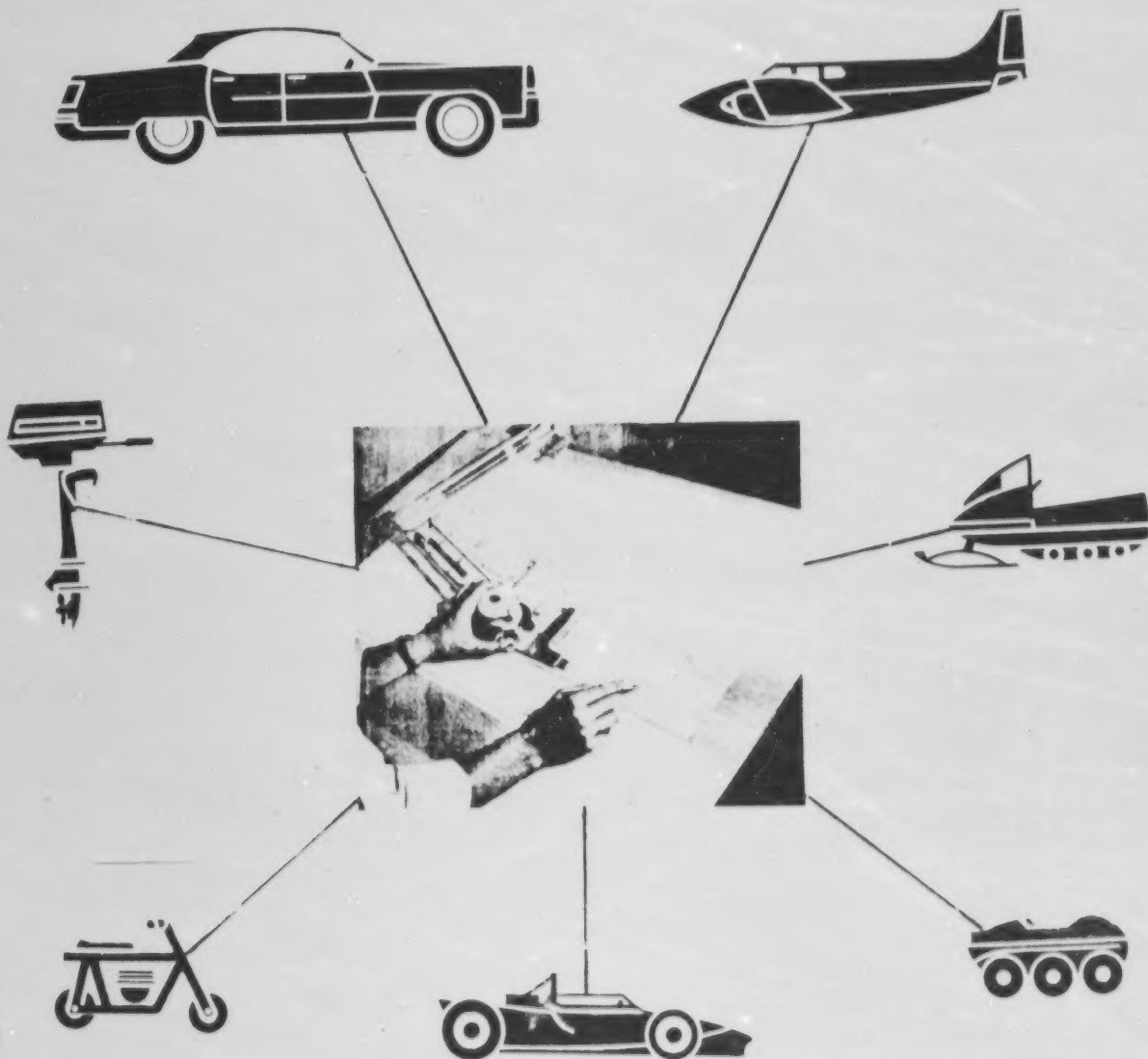
- * Should the instructor feel that more practice is needed, he may assign additional problems.







RESEARCH PROJECT
SANFORD CENTRAL HIGH SCHOOL
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CE003933(6)

CLUSTER: DRAFTING
COURSE: BASIC TECHNICAL DRAFTING

DM-II

UNIT PACKAGE 1: SCREW THREADS AND FASTENERS

PREREQUISITES: NONE

RATIONALE:

Have you noticed? Look around you and you will see screw threads. They're everywhere. Do you know what function they serve? Sure, they hold things together and they help provide motion for some parts. There are different types, sizes and configurations of screw threads and the draftsman needs to be familiar with the terminology and the principles of drawing these threads.

So many things depend on the screw thread for fastener and other functional concerns that industry needs draftsmen who are competent with the necessary skills to draw the various representations.

The draftsman will be concerned with the terminology, notes and other detailed items that are related to threads. Twist your head to knowledge and tighten up on the skills provided in the Objectives of this unit.

OBJECTIVES:GENERAL:

Upon completion of this unit package you will be able to identify the parts and draw the various types of threads used in industry.

SPECIFIC:

Upon completion of the task packages for this unit you will be able to:

1. List and define in writing six common terms related to threads.
Your performance will be evaluated in accordance with the instructor's checklist.
2. Identify, by listing on an illustration, all parts of a thread and thread notes. Your performance will be evaluated in accordance with the instructor's checklist.
3. Unified threads using the semi-conventional or detailed representation method. Your performance will be evaluated in accordance with the instructor's checklist.
4. The correct drafting techniques to draw acme threads using the semi-conventional or detailed representation method. Your performance will be evaluated in accordance with the instructor's checklist.
5. Correctly draw square threads using the semi-conventional or detailed representation method. Your performance will be evaluated in accordance with the instructor's checklist.

OBJECTIVES (cont'd):

6. Correctly draw, from given thread notes, internal and external profiles using the following thread representations:

- a. simplified.
- b. schematic.

Your performance will be evaluated in accordance with the instructor's checklist.

7. Draw a regular square bolt and nut for a given major diameter.

Your performance will be evaluated in accordance with the instructor's checklist.

8. Draw a regular hexagon and nut for given major diameter.

Your performance will be evaluated in accordance with the instructor's checklist.

9. Identify, by listing in writing, machine, cap and set screws from an illustration. Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

In order to complete this unit successfully you should begin your work on Task Package 1, and then as a suggestion proceed to complete each task package in order until you have finished each package in this unit. In the packages you will be asked to view a sound-slide presentation, read and answer questions, and perform some practical exercises. The number and names of the task packages included in this unit are as follows.

LEARNING ACTIVITY (cont'd):

- TASK PACKAGE 1: DEFINITIONS OF SCREW THREAD TERMINOLOGY
- TASK PACKAGE 2: IDENTIFYING PARTS OF A THREAD AND THREAD NOTES
- TASK PACKAGE 3: DRAWING UNIFIED THREADS
- TASK PACKAGE 4: DRAWING ACME THREADS USING THE SEMI-CONVENTIONAL OR DETAILED REPRESENTATION METHOD
- TASK PACKAGE 5: DRAWING A SQUARE THREAD USING THE SEMI-CONVENTIONAL OR DETAILED REPRESENTATION METHOD
- TASK PACKAGE 6: DRAWING PROFILE OF SIMPLIFIED AND SCHEMATIC REPRESENTATIONS
- TASK PACKAGE 7: DRAWING A REGULAR SQUARE BOLT AND NUT
- TASK PACKAGE 8: DRAWING A HEX-HEAD BOLT AND NUT
- TASK PACKAGE 9: IDENTIFYING CAP, MACHINE AND SET SCREWS

If you should feel confident enough to pass a comprehensive test at this time, contact your instructor. However, should you feel you are not ready to be tested, begin your work as outlined above.

DM-II-1

UNIT II: SCREW THREADS AND FASTENERS

TASK PACKAGE 1: DEFINITIONS OF SCREW THREAD TERMINOLOGY

PREREQUISITES: NONE

RATIONALE:

The use of screw threads appears so frequently in the daily task of the draftsman that the common forms and methods of representation must be understood. The jobs that screws and other fasteners do are so vast that a draftsman needs to be able to identify the various types and the particular job that each does. The draftsman should be concerned with the basic terminology of screws and screw threads. The draftsman's language is graphical, and he must know the relationship between his representation of screws and threads and the correct terminology his symbols are to express. You need to have an accurate understanding of the terms that apply to screws and screw threads. "Get in the twist of things and tighten up all the screws in this package."

OBJECTIVE:

Upon completion of this task package you will be able to list and define in writing, six common terms related to threads. Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

1. Read pages 202-206 in Basic Technical Drawing.
2. Read pages 154-158 in Mechanical Drawing.
3. Review sound-slide presentation DM-II-1, today's terrific show.
4. Study Figure 405 on page 202 in Basic Technical Drawing.
Can you see the different items that are related to a helix?
5. Study Figure 406 on page 203 in Basic Technical Drawing.
Notice the difference between external and internal threads.
6. Study Figure 471 on page 205 in Basic Technical Drawing.
Notice the variations in the pitch of each example.
7. Study Figure 472 on page 205 in Basic Technical Drawing.
Do you see the difference between right and left-hand thread?
8. Study Figure 473 on page 206 in Basic Technical Drawing. Do
you see the difference between multiple threads?
9. Study Figure 12-6 on page 157 in Mechanical Drawing.

LEARNING ACTIVITY (cont'd):

10. Looks as though you're not goofing around. You've finished this Learning Activity. Check with your instructor before starting the Learning Practice.

LEARNING PRACTICE:

1. Study pages 202-206, section 202-208 in Basic Technical Drawing.
 - a. From the pages listed above find six terms related to screw threads.
 - b. List the terms found in part a on a sheet of paper. Leave two lines blank between each word.
 - c. Define the words found in a. • Use the space beside the word.
2. Study section 205, on page 204, in Basic Technical Drawing.
 - a. List five thread forms found in the above section. Leave two spaces between each listing.
 - b. Write the function of each thread form listed in a.
 - c. Sketch each thread form listed in a.
3. Study section 208, on page 206 in Basic Technical Drawing.
 - a. Write an explanation as to the relationship between lead and pitch.
4. Be sure your name, today's date and this package number are on your paper.
5. Now tell me, how many of your friends could do this? I know they couldn't do it like you do it. Take your work to the instructor for an evaluation. Beethoven was a perfectionist - why shouldn't you be one?

DM-11-2-

UNIT 11: SCREW THREADS AND FASTENERS

TASK PACKAGE 2: IDENTIFYING PARTS OF A THREAD AND THREAD NOTES

PREREQUISITES: UNIT 11, TASK PACKAGE 1

RATIONALE:

The draftsman should not only be skillful in the drawing of threads, but he should possess a knowledge of the parts of a thread. Knowing the parts of a thread and the function they serve will greatly enhance the draftsman's ability to represent his ideas.

You know a thread note is not a note from a fouled-up musical instrument. The thread note gives information about a thread in a simplified form; a type of shorthand used by the engineer and draftsman. You will take "note" of this task package and give answers to the given questions.

OBJECTIVE:

Upon completion of this task package you will be able to identify, by listing on an illustration, all parts of a thread and thread notes. Your work will be checked in accordance with the instructor's evaluation.

LEARNING ACTIVITIES:

1. Review pages 202-205 and activities 210 on page 214 in Basic Technical Drawing.
2. Review pages 154-155 in Mechanical Drawing.
3. Review the sound-slide presentation DM-11-2.
4. Study figure 12.4a on page 155 in Mechanical Drawing. Notice the difference between an internal and external thread.
5. Notice in figure 12.4a how the external thread goes in one direction and the internal thread goes in the opposite direction.
6. Study figure 467 on page 274 in Basic Technical Drawing. Notice the five places of information given in the thread notes.
7. Notice also views 2, 3, 4, and 5 in figure 467. Study the different types of threads.
8. Study figure 468 on page 274 in Basic Technical Drawing.
9. Notice the 3/8-16 UNC 2A thread of a screw thread.
10. Study paragraph 12.4 on page 155 in Mechanical Drawing. Notice the three thread systems and how they are shown in figure 2 on the same page, which is also on the DM-11-2 sound slide.
11. Don't forget to check the standard thread symbols. Check with your instructor.

LEARNING PRACTICE:

DIRECTIONS: Read the entire Learning Practice before starting to work.

1. Turn to page 4 in this task package.
 - a. Fill in the blank on page 4 with the correct term.
2. Turn to page 3 in this task package.
 - a. Fill in the blank on page 3 with the correct part of the thread note.
3. Congratulations! You've just drawn up any blanks in designing yourself a career in drafting.



- ① _____
- ② _____
- ③ _____
- ④ _____
- ⑤ _____
- ⑥ _____
- ⑦ _____
- ⑧ _____

Identify the part of the ...

Identify the part of the ... in space provided below. Write the correct item the ... in figure 2.



Figure 2

05-11-1

06-15-11-2

Upon completion of this task package you will be able to draw unified threads using the semi-conventional or detailed representation method. Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING OBJECTIVES

1. Read and understand the task and objectives of the task.

2. Draw the unified threads using the semi-conventional or detailed representation method.

3. Draw the unified threads using the semi-conventional or detailed representation method.

4. Draw the unified threads using the semi-conventional or detailed representation method.

5. Draw the unified threads using the semi-conventional or detailed representation method.

6. Draw the unified threads using the semi-conventional or detailed representation method.

7. Draw the unified threads using the semi-conventional or detailed representation method.

8. Draw the unified threads using the semi-conventional or detailed representation method.

9. Draw the unified threads using the semi-conventional or detailed representation method.

10. Draw the unified threads using the semi-conventional or detailed representation method.

11. Draw the unified threads using the semi-conventional or detailed representation method.

12. Draw the unified threads using the semi-conventional or detailed representation method.

13. Draw the unified threads using the semi-conventional or detailed representation method.

14. Draw the unified threads using the semi-conventional or detailed representation method.

15. Draw the unified threads using the semi-conventional or detailed representation method.

Unit 11

Unit 11: The Thread of Life

Objectives: Students will be able to use the semi-conventional or
detailed representative method.

Prerequisites: Unit 10, Task Packages 1 - 3

Rationale:

For the first time, students will be able to "Get on into
this one and see how it works." (Coulter, 1980, p. 10)

For the first time, students will be able to use the semi-conventional
representative method. This package
provides the student with the necessary information to use this type of thread
drawing. The student will be able to use this information in engineering
drawings. The student will be able to use this information in the translation
of words, symbols, and numbers into a visual representation of a mechanical
part. The student will be able to use this information in the translation
of words, symbols, and numbers into a visual representation of a mechanical
part. The student will be able to use this information in the translation
of words, symbols, and numbers into a visual representation of a mechanical
part.

OBJECTIVE:

Upon completion of this task package you will be able to use the correct drafting techniques to draw acme threads, using the semi-conventional or detailed representation method. Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

1. Read section 212 on pages 209 and 210 in Basic Technical Drawing.
2. Read section 12.13 on page 161 in Mechanical Drawing.
3. Study figure 12.13 on page 161 in Mechanical Drawing.
4. Does the acme thread in Figure 12.13 have multiple threads?

5. At what angle does the crest line cut the axis of the thread?

6. Study figure 479 on page 209 in Basic Technical Drawing.
7. Study the tables on pages 346, 347 and 348 in Basic Technical Drawing.
8. Study figure 480 on page 209 in Basic Technical Drawing.
9. How is the depth of the thread determined on an acme thread?

LEARNING ACTIVITY (cont'd):

10. Looks as though you're in the swing of things. So, keep swinging right over to the instructor with your answers.

LEARNING PRACTICE:

DIRECTIONS: Read the entire Learning Practice before starting to work.

1. Obtain a sheet of paper from your instructor.
2. Draw an acme thread with a $3/4$ " major diameter.
 - a. Prepare your paper using layout "C".
 - b. Study figure 480 on page 209 in Basic Technical Drawing.
 - c. Study the chart on page 348 in Basic Technical Drawing.
 - d. Using the upper half of your drawing, draw an acme thread with a $3/4$ " major diameter. Use the chart on page 348 to determine the pitch of the thread. Draw the thread 2" in length using the semi-conventional or detailed representation method.
(Place this view to the left on your paper; center with enough space to allow you to draw an internal representation near it.)
 - e. Using the same axis line, draw to the right the internal representation of an acme thread with a $3/4$ " major diameter, using the semi-conventional or detailed representation method.
Draw the representation 2" in length and $1\ 1/4$ " in height.
 - f. Label the screw-thread representation, using thread notes.

LEARNING PRACTICE (cont'd):

3. Draw an acme thread with a $1 \frac{1}{8}$ " major diameter.
 - a. Study the chart on page 348 in Basic Technical Drawing.
 - b. Using the bottom half of your drawing paper, and to the left, draw an acme thread with a $1 \frac{1}{8}$ " major diameter using the semi-conventional or detailed representation method. Use the chart on page 348 to determine the pitch of the threads. Draw the external thread representation 2" in length.
 - c. Draw an internal thread representation of an acme thread with a $1 \frac{1}{8}$ " major diameter. Draw the representation 2" in length and $1 \frac{1}{2}$ " in height, and use the same axis line employed for the external threads.
 - d. Label the screw-thread representation, using thread notes.
4. Congratulations! You've finished another package. Take your work to the instructor for an evaluation.

Each task package is a stepping-stone to higher accomplishment.

DM-II-5

UNIT II: SCREWS AND FASTENERS

TASK PACKAGE 5: DRAWING A SQUARE THREAD USING THE SEMI-CONVENTIONAL OR
DETAILED REPRESENTATION METHOD

PREREQUISITES: UNIT II, TASK PACKAGES 1-4

RATIONALE:

You don't have to be a square to draw a square thread. All you need to do is get squared away. If you're ready now, be skillful on the draw.

The square thread, just as the acme thread, is used to transmit power. The draftsman will be confronted with this type of thread as he will with the other two. The square thread is drawn to a similar degree as the acme thread. The pitches for both types of threads are derived from the same charts. The accomplishment of succeeding with this task package will give you yet another skill that you can employ in the conquest of drawing semiconventional representations of screw threads. Don't find yourself in a bind. Be prepared to "square-off" on the successful completion of this task package.

OBJECTIVE:

Upon completion of this task package you will be able to draw square threads using the semi-conventional or detailed representation method. Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

1. Read section 211 on pages 208-209 in Basic Technical Drawing.
2. Read section 12.12 on page 161 in Mechanical Drawing.
3. Study figure 12.12 on page 161 in Mechanical Drawing.
4. What is the lead for the threads in figure 12.12?

5. Study figure 478 on page 208 in Basic Technical Drawing.
6. Notice how the root and crest lines are drawn.
7. What is the depth of the threads in figure 478?

8. You've probably noticed the similar methods of construction between acme and square threads.
9. Study the chart on page 348 in Basic Technical Drawing.
10. Keep the faith, Baby! But don't keep the answers to this Learning Activity; give them to the instructor.

LEARNING PRACTICE:

DIRECTIONS: Read the entire Learning Practice before starting to work.

1. Obtain a sheet of paper from your instructor.
2. Draw a square thread with a $3/4$ " major diameter.
 - a. Prepare your paper using layout "C".
 - b. Study the chart on page 348 in Basic Technical Drawing.
 - c. Study figure 478 on page 208 in Basic Technical Drawing.
 - d. Using the upper half of your drawing paper, draw a series of external square threads with a major diameter of $3/4$ " using semi-conventional or detailed representation method. Draw the series of thread 2" in length on the left of your paper. (You will need to leave room to draw some internal representation; therefore, consider the neatness and balance of your views.)
 - e. Draw the internal representation for a square thread with a $3/4$ " major diameter using the semi-conventional or detailed representation method. Use the same axis as you did for the external representation. Draw the representation on the right of your paper with the representation 2" in length and $1\ 1/4$ " in height.
 - f. Label the representation using thread notes.
3. Draw a square thread with a $1\ 1/8$ " major diameter.

LEARNING PRACTICE (cont'd):

- a. Study the chart on page 348 in Basic Technical Drawing.
- b. Using the bottom half of your drawing paper, draw an external representation of a series of square threads with a $1 \frac{1}{8}$ " major diameter using the semi-conventional or detailed representation method. Draw the representation on the left of your paper, 2" in length. (Remember you will be required to draw an internal representation next.)
- c. Draw an internal representation of a series of square threads with a $1 \frac{1}{8}$ " major diameter using the semi-conventional or detailed representation method. Draw the representation on the right of your paper using the same axis as the external thread. Draw the internal representation 2" in length and $1 \frac{1}{2}$ " in height.
- d. Label the representation using thread notes.

Drafting seems to be your thing! Keep it up. Take your work to the instructor for his evaluation.

If you keep plugging hard, you may reach the acme of drafting.

DM-II-6

UNIT II: SCREWS AND FASTENERS

TASK PACKAGE 6: DRAWING PROFILE OF SIMPLIFIED AND SCHEMATIC
REPRESENTATIONS

PREREQUISITES: UNIT II, TASK PACKAGES 1 - 5

RATIONALE:

You have seen how to use the detailed method of representation to draw the square, acme and unified thread series. You will now come into contact with two other methods of representing threads on a drawing. These two methods are generally used when the major diameter is less than one inch. Methods for both internal and external thread are represented. A draftsman must have the needed skills when it comes to the ability of drawing the schematic and simplified methods of representing threads.

"Don't think this work is hard. Simplify with this task package."

OBJECTIVE:

Upon completion of this task package you will be able to correctly draw from given thread notes, internal and external profiles using the following thread representations:

- a. simplified
- b. schematic

Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

1. Read sections 214, 215, 216, 217, 218 on pages 211-214 in Basic Technical Drawing.
2. Read section 12-8 on pages 158-159, sections 12-10 and 12-11 on pages 160-161, sections 12-14, 12-15 and 12-16 on page 162 in Mechanical Drawing.
3. Review the sound-slide presentation DM-II-6.
4. Study figure 12-11 on page 161 in Mechanical Drawing.
5. What two basic lines of the thread are represented on the simplified method of drawing threads? _____

6. Study figures 12-10a and 12-10b on page 160 in Mechanical Drawing.
7. What other two lines are displayed in the schematic representation

LEARNING ACTIVITY (cont'd):

that were not shown in the simplified method? _____

8. Study figures 12-8b and 12-8c on page 159 in Mechanical Drawing.
9. Notice in figures 12-8b and 12-8c how the internal representations are drawn.
10. Study figure 484 on page 211 in Basic Technical Drawing.
Notice that the thread depth and the drill depth are not the same.
11. You will notice that the threads never go completely to the bottom of the drilled hole. The closest they go to the bottom is when you use a bottoming tap. If you have trouble with the figure 484, ask your instructor for help.
12. What are the five series of numbers of threads per inch used in the American Standard Screw Thread? _____
13. Study the table on pages 346-347 in Basic Technical Drawing.
14. What are the six different series of unified and American Screw Threads? _____
15. Do you know the difference between national coarse and national fine? Explain the difference between the two and how the threads are used. _____

LEARNING ACTIVITY (cont'd):

16. Study figure 485 on page 212 in Basic Technical Drawing.
17. What! Not another Learning Activity. Take your answers to the instructor.

LEARNING PRACTICE:

DIRECTIONS: Read the entire Learning Practice before starting to work.

1. Obtain a sheet of paper from the instructor.
2. Draw a schematic representation of an external thread.
 - a. Prepare your paper using layout "C".
 - b. Study the chart in figure 485 on page 212 in Basic Technical Drawing.
 - c. Using the upper half of your drawing paper, draw a schematic representation of a thread whose thread note is $3/4 - 12 \text{ UN}-2\text{A}$. Draw the threads 1 1/2 inches in length. Place the view in the upper left corner of the paper.
 - d. Label the thread representation using the proper thread note.
3. Draw a simplified representation of an external thread.
 - a. Use the same axis line as in problem 2c.
 - b. Draw a simplified representation of an external thread, whose thread note is $3/4 - 12 \text{ UN}-2\text{A}$. Draw the threads 1 1/2 inches in length and in the upper right corner of the paper.
 - c. Label the thread representation using the proper thread note.

LEARNING PRACTICE (cont'd):

4. Draw a schematic representation of an internal thread.
 - a. Using the lower half of your drawing paper, draw a schematic representation of an internal thread whose thread note is 1 - 8 UNC-2B. Draw the threads 1 1/2 inches in length and 1 1/2 inches high. Place the drawing in the lower left corner of the paper.
5. Draw a simplified representation of an internal thread.
 - a. Use the same axis line, as in problem 4a.
 - b. Draw a simplified representation of an internal thread whose note is 1 - 8 UNC-2B. Draw the thread 1 1/2 inches in length and 1 1/2 inches high. Place the drawing in the bottom right corner of your paper.
6. You've got a lot to live and a task package has a lot to give; but right now give the instructor your work so he can evaluate it.

DN-II-7

UNIT II: SCREWS AND FASTENERS

TASK PACKAGE 7: DRAWING A REGULAR SQUARE BOLT AND NUT

PREREQUISITES: UNIT II, TASK PACKAGES 1 - 6

RATIONALE:

Bolts and nuts are threaded fasteners which are used frequently to hold parts of an object in position. A draftsman when drawing parts of machinery may encounter bolts; so, therefore, he should develop a skill for drawing the various types of bolts. This package is centered around the square head bolt. You will find that bolts are not just haphazardly made. They are designed for different jobs. Your ability to correctly draw square bolts will give you one more skill for your job. "Don't be flashing around like a lightning bolt; let's tie down this package with a square head bolt."

OBJECTIVE:

Upon completion of this task package you will be able to draw a regular square bolt and nut for a given major diameter. Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

1. Read sections 221, 222, and 223 on pages 215-218 in Basic Technical Drawing.
2. Read sections 12-18, 12-19, 12-20, 12-21, 12-22 on pages 163 - 165 in Mechanical Drawing.
3. Study figure 12-21 on page 164 in Mechanical Drawing. Notice this square bolt head is drawn across the flats.
4. Study figure 12-19b on page 164 in Mechanical Drawing.
5. Notice that the only thing given in figure 12-19b is the diameter of the bolt. Full thickness and width of the head and nut are then derived from this information.
6. Study figure 12-22 on page 165 in Mechanical Drawing. This figure shows the square head bolt drawn across the corners.
7. Study figure 489 on page 215 in Basic Technical Drawing.
8. From where on a bolt is the length measured? _____

9. Study figure 490 on page 216 in Basic Technical Drawing.
10. Notice that even the thread length on a bolt is determined by the major diameter. What is the formula for minimum thread length on a bolt? _____

11. What are the two series of bolts? _____

LEARNING ACTIVITY (cont'd):

12. What are the three types of finishes? _____

13. Study figures 12-18a and 12-18b on page 163 in Mechanical Drawing.
14. How thick is the washer face on a bolt? _____
How thick do you draw it? _____
15. How do you find the thickness of the nut? _____

16. Finally! Finished with this Learning Activity! Sure has been a long one, but we hope you have it "bolted" down. Take your answers to the instructor.

LEARNING PRACTICE:

DIRECTIONS: Read the entire Learning Practice before starting to work.

1. Obtain two sheets of paper from your instructor.
2. Draw an American Standard square bolt.
 - a. Prepare your paper using layout "C".
 - b. Study problem 12-9 on page 479 in Mechanical Drawing.
 - c. Following the directions listed in problem 12-9 draw a square head bolt as shown in the illustration. Use a full scale and remember to space your views on the paper so that your work will be orderly and neat.

LEARNING PRACTICE (cont'd):

3. Draw a square bolt for problem 12-19.
 - a. Prepare your paper using layout "C".
 - b. Study problem 12-19 on page 481 in Mechanical Drawing.
 - c. Study the illustration that is used for problem 12-19.
 - d. Using the information for the size description of the object, draw the object in the center of your drawing paper. Use a scale of 2" = 1".
 - e. Draw a bolt in the proper location holding the object together. Use the information given in the chart and as listed for problem 12-19.
 - f. Dimension the object and label the bolt with the correct information specified in thread notes.

Say! You are coming on strong. Drafting could be your thing. Take your work to the instructor for evaluation.

DM-II-8

UNIT II: SCREW THREADS AND FASTENERS

TASK PACKAGE 8: DRAWING A HEX-HEAD BOLT AND NUT

PREREQUISITES: UNIT II, TASK PACKAGES 1-7

RATIONALE:

Now, don't let bolts and nuts put the "hex" on you. This is not a course in voodoo, you know. This is a course in you do. You do the work well and you do benefit from it.

The most common bolt you will probably encounter as you progress through life is the hexagonal-head bolt, more affectionately referred to as the hex-head bolt. You will need to know how to draw this particular type of bolt because, as stated before, it is the most prevalent one used today. The hex-head bolt is very much akin to the square bolt - the only difference being naturally in the head and sometimes the type of finish used for the bolt. "Don't let anyone put a "hex" on you then; hustle through this task package and you'll find it will help you to tighten your skills with fasteners."

OBJECTIVE:

Upon the completion of this task package you will be able to draw a regular hexagon-head bolt and nut for a given major diameter. Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

1. Read sections 12-17, 12-18, 12-19, 12-20, on pages 162-164; and sections 12-23, 12-24, on pages 165-166 in Mechanical Drawing.
2. Review pages 215-218 in Basic Technical Drawing.
3. Review the sound-slide presentation DM-II-8.
4. Study figure 489 on page 215 in Basic Technical Drawing.
5. Notice that one of the basic differences between the hexagon-head and square-head bolt is that the hex-head has a washer face.
6. Study figure 491 on page 216 in Basic Technical Drawing.
7. How is the head size of the hexagon-headed bolt determined?

8. How is the thickness of the nut determined? _____

9. Study figure 492 on page 217 in Basic Technical Drawing.
10. Study figure 12-19a on page 164 in Mechanical Drawing.
11. Study figure 12-20 on page 164 in Mechanical Drawing.

LEARNING ACTIVITY (cont'd):

12. How is the distance across the flat determined on a heavy hexagonal bolthead? _____

13. Study figure 12-23b on page 166 in Mechanical Drawing.
14. Study figure 12-24 on page 166 in Mechanical Drawing.
15. Look at illustration c in figure 12-24. Notice how the bolt does not "bottom out." You like that term? It means the bolt does not reach the bottom of the tapped hole.
16. Task packages make the world go round. Now round up your answers and take them to the instructor.

LEARNING PRACTICE:

DIRECTIONS: Read the entire Learning Practice before starting to work.

1. Obtain two sheets of paper from the instructor.
2. Draw a hexagonal-head bolt.
 - a. Prepare your paper using layout "C".
 - b. Study problem 12-8 on page 479 in Mechanical Drawing.
 - c. Following the directions given in problem 12-8, draw a hexagonal head bolt as shown in the illustration. Use a full scale and remember to space your views on the paper so that your work will be neat and orderly.

LEARNING PRACTICE (cont'd):

3. Draw a bolt for problem 12-14 on page 481 in Mechanical Drawing.
 - a. Prepare your paper using layout "C".
 - b. Study problem 12-14 on page 481 in Mechanical Drawing.
 - c. Study the chart related to problem 12-14 on page 481.
 - d. Draw the object in problem 12-14, using the size description listed in the chart.
 - e. Draw a bolt to fit in the proper place in problem 12-14. Use the information stated in the chart.
 - f. Use a scale of 2" = 1".

You're tooling right along. Don't let anything "hole" you up. Take your answers to the instructor.

Magellan's crew sailed around the world, and you're sailing around to a career in drafting.

DM-11-9

UNIT 11: SCREW THREADS AND FASTENERS

TASK PACKAGE 9: IDENTIFYING CAP, MACHINE AND SET SCREWS

PREREQUISITES: UNIT 11, TASK PACKAGES 1-8

RATIONALE:

Set your cap for the study of machine screws. You need to know about them so you can cap this unit off. Then you can set sail toward the next unit.

This unit is concluded with the study of cap, machine and set screws. The draftsman needs to know how to identify the types of screws and have a knowledge of what their function is in the engineering field. The cap and machine screws are closely related. They almost look alike. You will be interested to know what the difference is between machine and cap screws. You will find that set screws are divided by two items. The draftsman needs to know the distinction and how this would affect some machine part or design feature.

You know when they drill for oil and finally achieve their goal they have to "cap" the well. Look for your "rich" success when you "cap" this package.

OBJECTIVE:

Upon completion of this task package you will be able to identify, by listing in writing; machine, cap and set screws from an illustration. Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

1. Read pages 218-223 in Basic Technical Drawing.
2. Read pages 167-171 in Mechanical Drawing.
3. Review sound-slide presentation DM-II-9 a really fine show.
4. Study figure 12-26 on page 167 in Mechanical Drawing.
5. Notice the different types of heads the cap screws have.
6. Study figure 12-27 on page 167 in Mechanical Drawing.
7. Notice the various heads used on machine screws.
8. Study figure 12-28 on page 168 in Mechanical Drawing. Notice the different points set screws have.
Study figure 495 on page 219 in Basic Technical Drawing.
10. Study figure 497 on page 220 in Basic Technical Drawing.
11. Study figure 498 on page 221 in Basic Technical Drawing.
12. Good!! The successful completion of another Learning Activity.
I'm glad you're holding firm like a "set screw."

LEARNING PRACTICE:

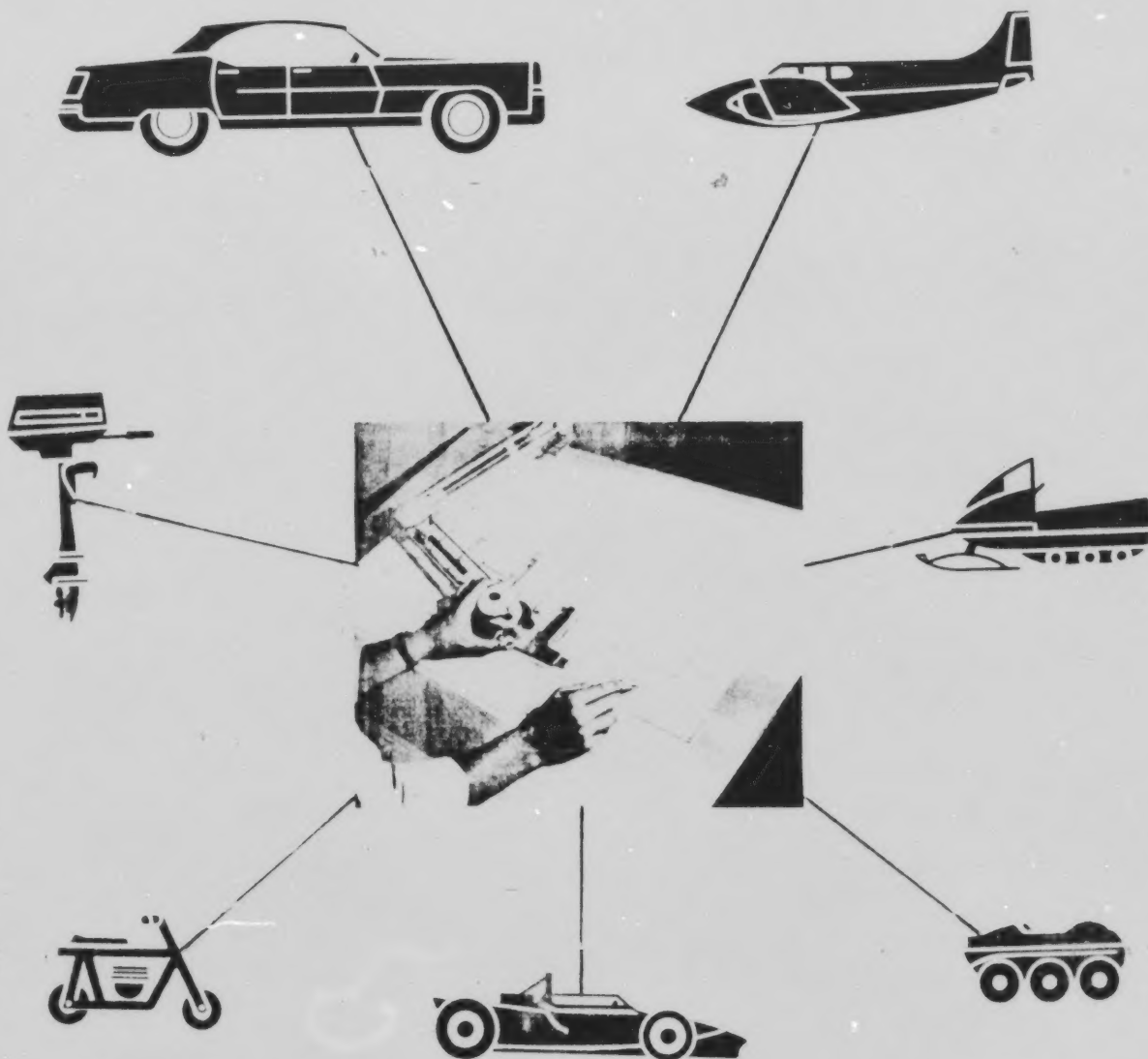
DIRECTIONS: Read the entire Learning Practice before starting to work.

1. Listing American Standard Cap Screws:
 - a. Turn to figure 495 on page 219 in Basic Technical Drawing.
 - b. List the five types of cap screws found in the illustration.
 - c. How many of the screws have their heads above the material?
2. Listing the American Standard Machine Screw:
 - a. Turn to figure 497 on page 220 in Basic Technical Drawing.
 - b. List the four types of machine screws found in the illustration.
 - c. Which type of machine screw head is located above the surface of material when it is in use?
3. Listing the American Standard Set Screws:
 - a. Turn to figure 498 on page 221 in Basic Technical Drawing.
 - b. List the four types of heads you will find on a set screw.
 - c. List the six different types of points you may find on a set screw.
4. Don't become "set" in your ways. Take your answers to the instructor so he can put a "cap" on the evaluation of your work.

If you're a creative individual - and most people are more creative than they may realize - then drafting must really be turning you on.



RESEARCH PROJECT
SANFORD CENTRAL HIGH SCHOOL
1708 NASH STREET
SANFORD, NORTH CAROLINA 27330



CE003933(c)

CLUSTER: DRAFTING
COURSE: BASIC TECHNICAL DRAFTING

DM-III

UNIT PACKAGE III: CAMS AND GEARS

PREREQUISITES: NONE

RATIONALE:

No one likes a "hammy cam", nor does anyone approve of stripped gears. You will, however, learn to draw cams and gears in this package.

A draftsman needs to know how a cam and a gear function. He should know the basic principles and how these apply to his job. Industry uses a lot of cams and gears and the draftsman is called upon to draw representations of both. Don't find yourself in a bind; finish this unit in time by gearing it up.

OBJECTIVES:

GENERAL:

Upon completion of this unit package you will be able to identify and draw various types of cams and gears used in industry.

SPECIFIC:

Upon completion of the task packages for this unit, you will be able to:

1. Do the following with respect to cams with harmonic, uniform and uniformly accelerated motion:
 - a. name in writing the three parts required for a cam to deliver motion.
 - b. define in writing the basic terms used in constructing these cams.

Your performance will be evaluated in accordance with the instructor's checklist.

OBJECTIVES (cont'd):

2. Draw a cam which produces uniform motion and its displacement diagram. You will be provided with the base circle, follower size, rise, dwell and rotation data. Your performance will be evaluated in accordance with the instructor's checklist.
3. Draw a cam which produces harmonic motion and its displacement diagram. You will be provided with the base diameter, follower size, dwell, rise, rotation and motion data. Your performance will be evaluated in accordance with the instructor's checklist.
4. Correctly draw a cam which produces uniformly accelerated motion and its displacement diagram. You will be provided with the base diameter, follower size, dwell, rise, rotation and motion data. Your performance will be evaluated in accordance with the instructor's checklist.
5. Perform the following exercises related to spur gears:
 - a. list, from an illustration, the terms used in spur gears.
 - b. define the terms used in spur gears.Your performance will be evaluated in accordance with the instructor's checklist.
6. Given the diametral pitch, pitch diameter, number of teeth, and formulas for spur gears, perform the following:
 - a. calculate the dimensions of a spur gear.
 - b. correctly construct a spur gear tooth profile.Your performance will be evaluated in accordance with the instructor's checklist.

OBJECTIVES (cont'd):

7. Given the diametral pitch, pitch diameter, number of teeth, and formulas for spur gears, perform the following:
 - a. calculate the dimensions of a spur gear.
 - b. correctly construct a spur gear using simplified representation.Your performance will be evaluated in accordance with the instructor's checklist.
8. Given the diametral pitch, pitch diameter, number of teeth, and the formulas for spur gears, perform the following:
 - a. calculate the dimensions of a spur gear.
 - b. correctly construct a spur gear using conventional representation.Your performance will be evaluated in accordance with the instructor's checklist.
9. List in writing, from an illustration, the terminology used in bevel gear application. Your performance will be evaluated in accordance with the instructor's checklist.
10. Accurately construct, from given information, a working drawing of a set of bevel gears. Your performance will be evaluated in accordance with the instructor's checklist.
11. List in writing, from an illustration, the terms used in worm gear application. Your performance will be evaluated in accordance with the instructor's checklist.

OBJECTIVES (cont'd):

12. Accurately construct a working drawing of a worm and worm gear.

Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY

In order to complete this unit successfully, you should begin your work on Task Package 1, and then as a suggestion, proceed to complete each task package in order until you have finished each package in this unit. In the package, you will be asked to view a sound-slide presentation, read and answer questions, and perform some practical exercises. The number and names of the task packages included in this unit are as follows:

- TASK PACKAGE 1: IDENTIFICATION OF BASIC PARTS OF A CAM
- TASK PACKAGE 2: DRAWING A CAM PROFILE WHICH PRODUCES UNIFORM MOTION
- TASK PACKAGE 3: DRAWING A CAM PROFILE WHICH PRODUCES HARMONIC MOTION
- TASK PACKAGE 4: DRAWING A CAM PROFILE WHICH PRODUCES UNIFORMLY ACCELERATED MOTION
- TASK PACKAGE 5: FORMULAS AND TERMINOLOGY USED IN SPUR GEAR APPLICATION
- TASK PACKAGE 6: CONSTRUCTION OF SPUR GEAR TOOTH PROFILE
- TASK PACKAGE 7: DRAWING A SPUR GEAR USING SIMPLIFIED REPRESENTATION
- TASK PACKAGE 8: DRAWING A SPUR GEAR IN CONVENTIONAL REPRESENTATION
- TASK PACKAGE 9: IDENTIFICATION AND DEFINITION OF PARTS
- TASK PACKAGE 10: DRAWING A SET OF BEVEL GEARS

LEARNING ACTIVITY (cont'd):

TASK PACKAGE 11: LISTING TERMS USED IN WORM GEAR APPLICATION

TASK PACKAGE 12: DRAWING A WORM AND WORM GEAR

If you should feel confident enough to pass a comprehensive test at this time, contact your instructor. However, should you feel you are not ready to be tested, begin your work as outlined above.

DM-III-1

UNIT III: CAMS AND GEARS

TASK PACKAGE 1: IDENTIFIES BASIC PARTS OF A CAM

PREREQUISITES: NONE

RATIONALE:

What is a cam? Sure you've heard of one, but do you know the function it performs? This package is about cams and the terms related to them. The draftsman that works in industry will eventually encounter cams of one type or another. The draftsman needs to have an understanding of how the cam works, and what it is supposed to do. Finally, he should be able to construct one from given information. "Torque up your skills by accelerating through this task package. It may even advance your timing in completion of this unit. And be sure to keep your eye on the taskchometer."

OBJECTIVE:

Upon completion of this task package you will be able to do the following with respect to cams with harmonic, uniform and uniformly accelerated motion:

- a. name in writing the three parts required for a cam to deliver motion.
- b. define in writing the basic terms used in constructing these cams.

Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

1. Read section 319 on pages 323-325 in Basic Technical Drawing.
2. Read sections 19.1-19.6 on pages 280-285 in Mechanical Drawing.
3. Review sound-slide presentation DM-III-1, the cat's meow!
4. Study figure 19.2b and 19.2c on page 280 in Mechanical Drawing.
Notice the difference between the two cams.
5. In figures 19.2b and c you will see that the follower in each one travels in a different direction.
6. Study figure 19.2d on page 280 in Mechanical Drawing.
7. Look closely at the illustrations in figure 19.2d. Do you see how, as the cam rotates, the follower rises?

LEARNING ACTIVITY (cont'd):

8. Study figure 19.3d on page 281 in Mechanical Drawing.
9. Study figure 19.4 on page 282 in Mechanical Drawing.
10. Notice the displacement chart in part b of figure 19.4. This chart shows the type of motion employed on the cam.
11. Study figure 19.5 on page 283 in Mechanical Drawing. Look carefully and see if you can detect the difference in the motions.
12. Study figures 658 and 659 on page 324 in Basic Technical Drawing.
13. Notice the types of cams in figure 658.
14. In figure 659, notice that the theoretical curve is the center of the follower as it travels around the cam.
15. Now that you've revved up with the Learning Activity, move on, Snoopy, move on.

LEARNING PRACTICE:

DIRECTIONS: Read the entire Learning Practice before starting to work.

1. List the three parts required for a cam to deliver motion.
 - a. Turn to page 324 in Basic Technical Drawing and study figure 658.
 - b. List the parts required for a cam to deliver motion. _____

 - c. Turn to page 324 in Basic Technical Drawing and study figure 659.
 - d. In which direction will the follower go on this cam? _____

LEARNING PRACTICE (cont'd):

2. List the basic terms used in constructing cams.
 - a. Turn to page 324 in Basic Technical Drawing and study figure 659.
 - b. List the terms used in cam construction. _____

 - c. Define the terms listed in b.

 - d. What is the difference between the working curve and the theoretical curve? _____

3. Rise up to the completion of this task package by taking your answers to the instructor. He may also have some additional information for your.

A little extra effort will go a long way!

DM-III-2

UNIT III: CAMS AND GEARS

TASK PACKAGE 2: DRAWING A CAM PROFILE WHICH PRODUCES UNIFORM MOTION

PREREQUISITES: UNIT III, TASK PACKAGE 1

RATIONALE:

Now, the word "cam" is not the abbreviation of "candied yam". Undoubtedly, you are familiar with the candied yam. Well, in this package you can get to know the cam.

Believe me, friend, you're going to really get a "cam" out of this task package. Yes, you are going to draw a cam that uses uniform motion. Why? Well, have you considered the possibility of how many cams are used in industry? You, as a draftsman, have to have all the facts and skills you can master when it comes to cams. The more you know, the more you can draw. This task package can be the start of something new. Of course, the prime ingredient is yourself. You are the key. Turn on the ignition and let's wheel through some cams.

OBJECTIVE:

Upon completion of this task package you will be able to draw a cam profile which produces uniform motion and its displacement diagram. You will be provided with the base circle, follower size, rise, rotation and motion data. Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

1. Review pages 280 - 285 in Mechanical Drawing.
2. Review pages 323 - 325 in Basic Technical Drawing.
3. Review sound-slide presentation DM-II-2.
4. Study figure 659 on page 324 in Basic Technical Drawing.
5. Notice in figure 659 where the roller is located.
6. Does the theoretical curve intersect the center of the roller?

7. What is the working curve? _____
8. How many parts is the distance the follower travels divided into? _____
9. What is this distance traveled called? _____

10. Notice the base circle has been divided into 12 parts.

LEARNING ACTIVITY (cont'd):

11. The six points the follower will travel have been used to draw a series of arcs. Where do these arcs intersect?

12. The points of intersections represent what? _____

13. Notice the six positions of the roller other than the original one used. How much of the rise distance has the follower traveled when in the number 6 position? _____

14. Good show, Ole Chap!! Now, take your answers to the instructor.

LEARNING PRACTICE:

DIRECTIONS: Read the entire Learning Practice before starting to work.

1. Obtain a sheet of paper from your instructor.
2. Draw a cam with uniform motion and its displacement diagram.
 - a. Prepare your paper using layout "D".
 - b. Given the following:
 1. Follower = 1"D
 2. Base circle = 4"
 3. Rise = 2"
 4. Rise 2" with uniform motion
 5. Drop 2" with uniform motion
 6. Rotation counter clockwise

LEARNING PRACTICE (cont'd):

- c. Center your drawing 6 inches from the left border of your layout.
- d. Draw a cam profile with uniform motion using the above information. Employ a full scale.
- e. Label the parts and dimension the drawing.
- f. In the space on the right, draw the cam displacement diagram.
- g. If you have difficulty see your instructor.

Got this cam in the bag, have you!! Take your work to the instructor for an evaluation.

Take care in your work - and your work will take care of you.

DM-III-3

UNIT III: CAMS AND GEARS

TASK PACKAGE 3: DRAWING A CAM PROFILE WHICH PRODUCES HARMONIC MOTION

PREREQUISITES: UNIT III, TASK PACKAGES 1 - 2

RATIONALE:

Help!! This task package will help you add to the skill of drawing cams. This cam is a harmonic cam. No, it's not like the harmonica! But when drawn correctly the cam will employ sweet, smooth movement similar to the sweet notes of the harmonica. The draftsman can use his skill in drawing cams to further explain his graphical language. The harmonic cam is a smoother operating cam than the uniform-motion cam. "So let's be uniform in building our skills with cams."

OBJECTIVE:

Upon completion of this task package, you will be able to draw a cam profile which produces harmonic motion and its displacement diagram. You will be provided with the base diameter, follower size, rise, rotation and motion data. Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

1. Review pages 280 - 285 in Mechanical Drawing.
2. Review pages 323 - 325 in Basic Technical Drawing.
3. Review sound-slide presentation DM-III-3.
4. Study figure 19-5(b) on page 283 in Mechanical Drawing.
5. What motion eliminates shock at the beginning and end of the follower's displacement? _____
6. How is the diameter of the semicircle used to layout harmonic motion determined? _____

7. The angular divisions of this semicircle represent what? _____

8. In harmonic motion, is the rise constant? _____
9. So, you're humming along, are you? Take your answers to the instructor.

LEARNING PRACTICE:

DIRECTOR NS: Read the entire Learning Practice before you start to work.

1. Obtain a sheet of paper from the instructor. He will give you the proper layout to use on your paper.
2. Draw a cam with harmonic motion.
 - a. Prepare your paper using the proper layout.

LEARNING PRACTICE (cont'd):

- b. Given the following:
 - 1. Follower 1"D
 - 2. Base circle 4"
 - 3. Rise = 2"
 - 4. Rise 2" with harmonic motion
 - 5. Drop 2" with harmonic motion
 - 6. Rotation counter clockwise
- c. Center your drawing 6 inches from the left border of your layout.
- d. Draw a cam with harmonic motion using the above information.
Employ a full scale.
- e. Label the parts and dimension the drawing.
- f. In the space on the right draw the cam displacement diagram.
- g. If you have difficulty, ask your instructor.

"Keep grooving with these cams. You're doing as well as I am." Take your work to the instructor for an evaluation. These task packages have better ideas, don't they?

DM-III-4

UNIT III: CAMS AND GEARS

TASK PACKAGE 4: DRAWING A CAM PROFILE WHICH PRODUCES UNIFORMLY
ACCELERATED MOTION

PREREQUISITES: UNIT III, TASK PACKAGES 1 - 3

RATIONALE:

You are about to begin the last task package on cams with the skills obtained in the previous two packages. You will definitely be a "cammy" individual. These skills will help you develop the three basic types of cams used in the engineering world. The three are somewhat related, yet each cam functions in its own world, just as a draftsman does in his own world. Gather your facts and let's "accelerate uniformity" through this learning package without any bumps.

OBJECTIVE:

Upon completion of this task package you will be able to correctly draw a cam profile which produces uniformly accelerated motion and its displacement diagram. You will be provided with the base diameter, follower size, rise, rotation, and motion facts. Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

1. Review pages 280 - 285 in Mechanical Drawing.
2. Review pages 323 - 325 in Basic Technical Drawing.
3. Review sound-slide presentation DM-III-4.
4. Study figure 19-5(c) on page 283 in Mechanical Drawing.
5. What is the difference between uniformly accelerated motion and harmonic motion?
6. How is the rise divided on uniformly accelerated motion?
7. In figure 19-5(c), notice how proportional the parts are in the rise. Do you know what proportional means in reference to this figure? You don't! Well, let's go through the whole process by the numbers.
 - a. First of all, we have established in our mind that the rise in figure 19-5(c) is AB.
 - b. The rise is divided into equal proportional parts. If you add the proportional parts 1:3:5, you get a total of a proportional part. This represents $1/2$ of the rise; therefore, the follower moves a total of one half AB.
 - c. The total of the proportional parts is 9. Now, we simply say that we are going to divide one half the rise into 9 proportional parts.

LEARNING ACTIVITY (cont'd):

Example below:

1 part = $1/9$

3 parts = $3/9$

5 parts = $5/9$

Total = $9/9$ = one half the rise

d. The last half of the rise is determined in the same manner.
Everything clear? Good. If problems still exist, see your instructor.

8. Can you believe you've done this Learning Activity? Accelerate to the Learning Practice.

LEARNING PRACTICE:

DIRECTIONS: Read the entire Learning Practice before starting to work.

1. Obtain a sheet of paper from your instructor.
2. Draw a cam profile with uniformly accelerated motion and its displacement diagram.
 - a. Prepare your paper using layout "D".
 - b. Given the following:
 1. Follower 1" D
 2. Base circle 4"
 3. Rise $2 \frac{1}{4}"$
 4. Rise $2 \frac{1}{4}"$ with uniformly accelerated motion
 5. Drop $2 \frac{1}{4}"$ with uniformly accelerated motion
 6. Rotation - counter clockwise

LEARNING PRACTICE (cont'd):

- c. Draw a cam profile with uniformly accelerated motion using the above information, using parts proportional to 1, 3, 5, 5, 3, 1. Employ a full scale.
- d. Label the parts and dimension the drawing.
- e. In the space to the right, draw the cam displacement diagram.
- f. If you have difficulty, see your instructor.

"You just keep beatin' your feet on that Mississippi mud, don't you"? Congratulations! Pat yourself on the back - no more than four times, please. Take your work to the instructor for an evaluation.

Take pride in your work - and your work will stand out.

DM-III-5

UNIT III: CAMS AND GEARS

TASK PACKAGE 5: FORMULAS AND TERMINOLOGY USED IN SPUR GEAR
APPLICATION

PREREQUISITES: NONE

RATIONALE:

Ready to shift gears for this package? It contains assignments that will spur you on to additional drafting skills.

"Gears make the world go around. Some big, some small, makes no difference at all." This is an important concept that the draftsman must grasp. He must be able to draw accurately the different types of gears.

This package is concerned with the parts and terminology of gears and the ideas behind their design. You will be able to improve your skill by mastering this task package. "So, don't slip any cogs while working this task package. Just gear it down to bite size."

OBJECTIVE:

Upon completion of this task package you will be able to perform the following related to spur gears:

- a. list, from an illustration, the terms used in spur gears.
- b. define the terms used in spur gears.

Your performance will be evaluated in accordance with the instructor's checklist

LEARNING ACTIVITY:

1. Read sections 19.7, 19.8, 19.9 on pages 285 - 287 in Mechanical Drawing.
2. Read sections 320 and 321 on pages 325-327 in Basic Technical Drawing.
3. Study figure 660 on page 325 in Basic Technical Drawing.
4. Notice the difference between the gear and the pinion. The pinion has fewer teeth, but they are still the same size of the teeth on the gear.
5. Study figure 662 on page 326 in Basic Technical Drawing.
6. Notice the different parts of the gear. Look carefully at the addendum and the dedendum. Did you know that the dedendum is larger than the addendum? This is because we add a clearance so that when the two teeth mesh they won't hang up.

LEARNING ACTIVITY (cont'd):

7. Notice the whole depth is just the sum of the addendum and the dedendum.
8. Also, notice the fillet on the gear tooth. Believe it or not, this little fillet adds strength to the gear tooth.
9. Study the formula on page 327 in Basic Technical Drawing.
10. Look at the gear formulas on page 287 in Mechanical Drawing.
11. Don't become confused because of the different styles of formulas found in both reference texts. You can see that the formulas are just the same but quoted in a different manner.
We will use those formulas in Basic Technical Drawing.
12. Study figure 19.9a on page 287 in Mechanical Drawing.
13. You can use the pressure angle to construct the base circle.
15. Check with your instructor to see if he has any comments.

LEARNING PRACTICE:

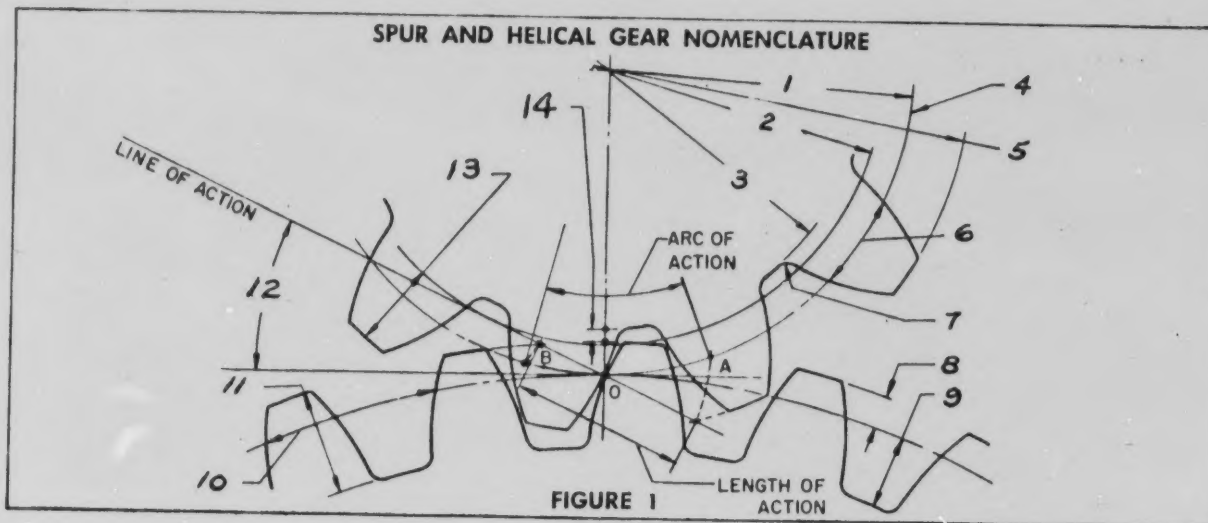
DIRECTIONS: Read the entire Learning Practice before starting to work.

1. List the parts of a gear tooth.
 - a. Turn to page 5 in this task package.
 - b. Study figure 1 of this task package.
 - c. List in writing on page 5 the correct answer for each blank.
2. Define the terms used with spur gears.
 - a. On the back of page 5, define the terms listed in 1.c above.

LEARNING PRACTICE (cont'd):

3. Give your work to the instructor for an evaluation. Let's get ourselves in gear for the next task package. "Pack up your gear and keep moving along to new knowledge."

It looks as if you're driving in high gear toward a drafting career!



- ① _____
- ② _____
- ③ _____
- ④ _____
- ⑤ _____
- ⑥ _____
- ⑦ _____

- ⑧ _____
- ⑨ _____
- ⑩ _____
- ⑪ _____
- ⑫ _____
- ⑬ _____
- ⑭ _____

DM-III-6

UNIT III: CAMS AND GEARS

TASK PACKAGE 6: CONSTRUCTION OF SPUR GEAR TOOTH PROFILE

PREREQUISITES: UNIT III, TASK PACKAGE 5

RATIONALE:

Gears really have a bite! With the set of teeth they have, they should. Do you know how to draw a spur gear tooth profile? Generally a lot of the gears are factory cut, but occasionally a draftsman may have to draw a different gear other than what can be purchased commercially. This package will assist you in obtaining the needed skill in drawing a tooth profile. The teeth of a gear are all made from a profile of just one tooth. You will need to know how to correctly draw a profile using both a 14 1/2" and 20° pressure angle. Let's see if you can "pressure" your way through this package.

OBJECTIVE:

Upon the completion of this task package you will be able to, given the diametral pitch, pitch diameter, number of teeth and the formulas for spur gears, perform the following:

- a. calculate the dimensions of a spur gear.
- b. correctly construct a spur gear tooth profile.

Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

1. Read sections 320 - 328 on pages 325 - 328 in Basic Technical Drawing.
2. Read sections 19.7 - 19.11 on pages 285 - 288 in Mechanical Drawing.
3. Study figure 662 on page 326 in Basic Technical Drawing.
4. Where is the "face" located on a gear tooth? _____

5. What does the term "working depth" mean? _____

6. If you had a gear with 24 teeth and a diametral pitch of 4, what would be the pitch diameter? _____

LEARNING ACTIVITY (cont'd):

7. If you had a gear with a pitch diameter of 8 and the number of teeth were 32, what would the diametral pitch be?

8. Look closely at the three items: number of teeth, diametral pitch and pitch diameter. The three items are relative. If one changes, it automatically changes one of the other two.
9. What is the base circle? _____

10. Just keep grinding them out, but don't slip a cog. Take your answers to the instructor.

LEARNING PRACTICE:

DIRECTIONS: Read the entire Learning Practice before starting to work.

1. Obtain a sheet of paper from your instructor.
2. Draw a spur gear tooth profile with a pressure angle of $14\frac{1}{2}^{\circ}$.
 - a. Turn to page 328 in Basic Technical Drawing.
 - b. Study figure 664.
 - c. Given the following:

$$N = 12$$

$$PD = 6$$

LEARNING PRACTICE (cont'd):

Find:

1. diametral pitch
 2. addendum
 3. dedendum
 4. circular pitch
 5. circular thickness
 6. root diameter
 7. clearance
 8. outside diameter
- d. Prepare your paper using layout "D".
 - e. Using the above information, draw a tooth profile of a spur gear using a pressure angle of $14\frac{1}{2}^{\circ}$.
 - f. Space your drawing so that you can place two profiles on one sheet of paper.
 - g. Draw all lines as construction lines. When you have drawn in the tooth profile, darken the lines more than the construction lines.
3. Draw a spur gear tooth profile with a pressure angle of 20° .
 - a. Given the following:
 $DP = 2$
 $PD = 8$

Find:

1. number of teeth
 2. addendum
 3. dedendum
 4. circular pitch
 5. circular thickness
 6. root diameter
 7. clearance
 8. outside diameter
- b. Draw a spur gear tooth profile using the above information with a pressure angle of 20° .
- c. Draw all lines as construction lines. When you have drawn in the tooth profile, darken all the lines more than the construction lines.

You're doing all right, baby! Take your work to the instructor for an evaluation.

Of course, a spur gear tooth profile is not as handsome as your profile!!

DM-III-7

UNIT III: CAMS AND GEARS

TASK PACKAGE 7: DRAWING A SPUR GEAR USING SIMPLIFIED REPRESENTATION

PREREQUISITES: UNIT III, TASK PACKAGE 6

RATIONALE:

The draftsman usually draws the spur gear in a simplified representation. To draw the spur gear in this manner does not take as long if he draws it in the conventional method. The draftsman lists all pertinent information of his drawing in a cutting data. The machinist then uses this information to cut the teeth of the spur gear. The information found on the drawing is limited because of the time factor, but still the draftsman wants to be conscientious in his work. Neatness is a by-product of a draftsman's efforts. "So, gather your wits and see if you can simplify this task package."

OBJECTIVE:

Upon completion of this task package you will be able to, given the diametral pitch, pitch diameter, number of teeth and the formulas for spur gears, perform the following:

- a. calculate the dimensions of spur gear.
- b. correctly construct a spur gear using simplified representation.

Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

1. Review pages 325 - 328 in Basic Technical Drawing.
2. Review pages 285 - 288 in Mechanical Drawing.
3. Study figure 19.11c on page 289 in Mechanical Drawing.
4. This is a simplified representation of a spur gear.
5. What is the pitch diameter of the gear in figure 19.11c?

6. What is the outside diameter of the spur gear? _____

7. What is the width of the tooth face? _____

LEARNING ACTIVITY (cont'd):

8. What is the pressure angle of the spur gear in figure 19.11c? _____

9. Notice the view on the right side of the paper. What do the three dotted lines on the very edge of the gear represent? _____

10. Study figure 665 on page 328 in Basic Technical Drawing.
11. What is the pitch diameter of this spur gear? _____

12. What is the addendum of the spur gear in figure 665? _____

13. What is the pressure angle of the spur gear? _____

14. Could this be magic? You've finished another Learning Activity.
Take your answers to the instructor.

LEARNING PRACTICE:

DIRECTIONS: Read the entire Learning Practice before
starting to work.

1. Obtain two sheets of paper from your instructor.
2. Draw a spur gear using the simplified representation.
 - a. Prepare your paper using layout "C."

LEARNING PRACTICE (cont'd):

- b. Given the following information:
PD = 6
N = 48
Hub length = 1 1/2"
 - c. Use remaining dimensions as far as practical from figure 665 on page 328 in Basic Technical Drawing.
 - d. Calculate the necessary information to draw a spur gear.
 - e. Draw a spur gear with a 14 1/2° pressure angle using the simplified method - using full scale.
 - f. Use figure 665 on page 328 in Basic Technical Drawing.
 - g. Construct a cutting data block similar to the one shown in figure 665 and list your information obtained in c.
3. Draw a spur gear using the simplified representation.
 - a. Prepare your paper using layout "C".
 - b. Using the dimensions given in figure 19-11a on page 288 in Mechanical Drawing, draw a spur gear with a 20° pressure angle using the simplified representation. Use full scale.
 - c. Construct a cutting data block similar to the one shown in figure 665 on page 328 in Basic Technical Drawing to list your information.
4. So you finished another task package. Take it to your instructor for an evaluation.

Your spurs are really jingling now! So gear up and right on!

DM-III-8

UNIT III: CAMS AND GEARS

TASK PACKAGE 8: DRAWING A SPUR GEAR IN CONVENTIONAL REPRESENTATION

PREREQUISITES: UNIT III, TASK PACKAGES 5 - 7

RATIONALE:

Ideas for gears are old and new. They date back at least to the Renaissance. This package should spur you on and gear you up for further drafting skills.

Did you know that Leonardo da Vinci drew ideas for gears back in the 1500's? His ideas sketched on paper conveyed his thoughts about the subject. You have the same opportunity today. You can express your thoughts about spur gears in conventional representation.

The draftsman at times may have to draw a conventional representation of a spur gear. It helps give workmen and other individuals an idea of what the whole gear looks like. Your idea may have to be conventional to conform to standards, but if you give it your all, then it will all be yours. Now, get in gear and move on.

OBJECTIVE:

Upon completion of this task package you will be able to, given the diametral pitch, pitch diameter, number of teeth and the formulas for spur gears, perform the following:

- a. calculate the dimensions of a spur gear.
- b. correctly construct a spur gear using the conventional method.

Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

1. Review sections 320, 321 and 322 on pages 325 - 328 in Basic Technical Drawing.
2. Review sections 19.7, 19.8, 19.9, 19.10 and 19.11 on pages 285 - 288 in Mechanical Drawing.
3. A conventional spur gear has all the teeth drawn.
4. Study figure 19.11a on page 288 in Mechanical Drawing.
5. How many teeth does this gear have? _____

6. What is the diametral pitch? _____

7. What is the pitch diameter? _____

LEARNING ACTIVITY (cont'd):

8. Study figure 1 on page 6 in this task package. The gear represented here shows all essential tooth data.
9. Notice the gear tooth data section.
10. Can you find the number of teeth listed? _____
11. Keeping in the groove by finishing another Learning Activity; give your answers to the instructor.

LEARNING PRACTICE:

DIRECTIONS: Read the entire Learning Practice before starting to work.

1. Obtain a sheet of paper from your instructor.
2. Draw a spur gear with a $14\frac{1}{2}^\circ$ pressure angle using the conventional representation.
 - a. Prepare your paper using layout "C".
 - b. Remember to center this drawing on your paper. "Neatness is a virtue."
 - c. Given the following:

$$N = 12$$

$$DP = 2$$

Find:

1. addendum
2. dedendum
3. outside diameter

LEARNING PRACTICE (cont'd):

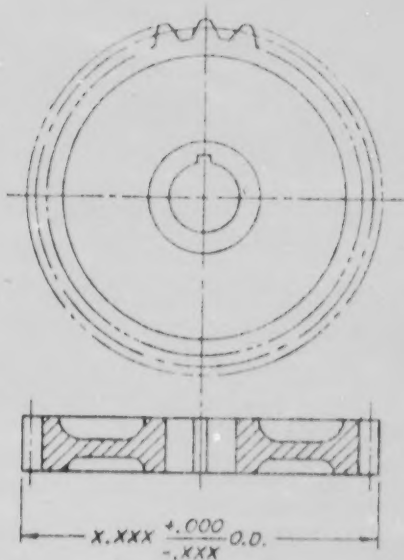
4. chordal thickness
 5. circular pitch
 6. root diameter
 7. pitch diameter
 8. clearance
- d. Employing the above information, construct a spur gear profile with a $14\frac{1}{2}^\circ$ pressure angle using the conventional method to draw three full teeth and a half tooth at each end of the full teeth. The remainder of the drawing may be drawn as a simplified representation.
 - e. When spacing the teeth around the pitch diameter, if you will use a compass or divider with a center wheel instead of the friction type, you will be able to set off the teeth more accurately.
 - f. If you find you are having difficulty, please check with your instructor.
 - g. Construct a cutting data box to list all your cutting information in.
- * Check with your instructor to see if additional practice is needed. If so, he may assign more practice.
3. Draw a spur gear with a 20° pressure angle using the conventional representation.

LEARNING PRACTICE (cont'd):

- a. Prepare your paper using layout "C".
- b. Center the drawing on your paper.
- c. Given the following:
PD = 6
DP = 4
Find:
 1. addendum
 2. dedendum
 3. outside diameter
 4. chordal thickness
 5. circular pitch
 6. root diameter
 7. number of teeth
 8. clearance
- d. Using the above information, construct a spur gear profile with a 20° pressure angle using the conventional method to draw three full teeth and a half tooth at each end of the full teeth. The remainder of the drawing may be drawn as a simplified representation.
- e. Construct a cutting data box to list all the cutting information in.

Right on with a task package! But carry your work right on to the instructor for an evaluation. Now you're really putting some teeth into your studies.

SPUR GEAR WITH ESSENTIAL TOOTH DATA



GEAR TOOTH DATA

NUMBER OF TEETH	XX
DIAMETRAL PITCH	XX
PRESSURE ANGLE	XX°
PITCH DIAMETER (REF.)	X.XXXX
CIRCULAR THICKNESS	.XXXX-.XXXX
WHOLE DEPTH, MINIMUM	.XXX
WORKING DEPTH	.XXX

FIGURE

DM-III-9

UNIT III: CAMS AND GEARS

TASK PACKAGE 9: IDENTIFICATION AND DEFINITION OF THE BEVEL GEAR

PREREQUISITES: UNIT III, TASK PACKAGES 5 - 8

RATIONALE:

There are different types of gears the draftsman will come into contact with. The bevel gear is one used rather frequently in industry. The gear has basically the same principle as the spur gear but it works in a different way. You need to master the terminology of bevel gears as presented in this task package. Knowing the correct names and their relationship to the overall bevel gear will help you to successfully complete this task package. "Don't keep things on the bevel; just rearrange them to put them on the level."

OBJECTIVE:

Upon completion of this task package you will be able to list in writing, from an illustration, the terminology used in bevel gear application. Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

1. Read section 323 on page 328 in Basic Technical Drawing.
2. Read sections 19.12 and 19.13 on pages 289 and 290 in Mechanical Drawing.
3. Study figures 19.12a and 19.12b on page 289 in Mechanical Drawing.
4. These figures illustrate rather clearly a set of bevel gears.
Notice how directional motion is changed with a bevel gear.
5. Study the list of terms and figure 19.13 on page 290 in Mechanical Drawing.
6. Notice the additional terms used in bevel gear terminology than in spur gear terminology.
7. Study figure 666 on page 329 in Basic Technical Drawing.
8. Notice the cutting data listed in the block.
9. Remember: even in the application of bevel gears, the larger is called the gear and the smaller is called the pinion.
10. Check with your instructor. He may want to bend your ear.

LEARNING PRACTICE:

DIRECTIONS: Read the entire Learning Practice before starting to work.

1. List the terms that apply to bevel gears.
 - a. Study the list of terms on page 290 in Mechanical Drawing.
 - b. On a sheet of ruled note paper list the terms on page 290.

LEARNING PRACTICE (cont'd):

- c. Which terms are new terms that apply only to bevel gears?

- d. The pitch cone affects what on the bevel gear?

- e. Study figure 19.14 on page 290 in Mechanical Drawing.

- f. What does the dimension $37^\circ - 22'$ represent?

- g. What does the dimension $2^\circ - 22'$ represent?

- h. What is the dimension of the crown backing on the gear in figure 290?

"You're breezing along, singing a song, entitled One More Task Package Done." Take your answers to the instructor for an evaluation.

It appears that you're on the level in your ambition to become a Draftsman.

DM-III-10

UNIT III: CAMS AND GEARS

TASK PACKAGE 10: DRAWING A SET OF BEVEL GEARS

PREREQUISITES: UNITS III, TASK PACKAGES 5 - 9

RATIONALE:

Don't strip your gears as a draftsman. Draw your gears. In fact, learn to draw all types of gears, including the bevel. This information is on the level.

The draftsman has to have the skill to draw gears of all types. A type covered in this task package is the bevel gear. These gears have teeth that are angled and they mesh at 90° to each other. The bevel gears have the same parts and terminology that the spur gear has, plus a few more for classification. You will not find this gear difficult if you have attained the skill of accomplishing a drawing of spur gears. Are you ready? Okay. The bevel gear is coming up.

OBJECTIVE:

Upon completion of this task package you will be able to accurately construct, from given information, a working drawing of a set of bevel gears. Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

1. Read section 324 on page 329 in Basic Technical Drawing.
2. Review sections 19.13 and 19.14 on page 290 in Mechanical Drawing.
3. If bevel gears intersect at a 90° angle, they are called what?

4. Study figure 666 on page 329 in Basic Technical Drawing.
5. What is the pitch diameter of the bevel gear? (Remember: the larger the gear, the smaller the pinion.)

6. What is the chordal addendum of the gear?

7. What is the chordal addendum of the pinion?

8. Study figure 19.14 on page 290 in Mechanical Drawing.
9. What is the size of the face cone in figure 19.14?

10. What is the pitch diameter of the gear in figure 19.14?

11. "Get this bevel on the level." Take your answers to the instructor.

LEARNING PRACTICE:

DIRECTIONS: Read the entire Learning Practice before starting to work.

LEARNING PRACTICE (cont'd):

1. Obtain a sheet of paper from the instructor.
2. Draw a set of bevel gears.
 - a. Prepare your paper using layout "D".
 - b. Study figure 666 on page 329 in Basic Technical Drawing.
 - c. Draw a working drawing of the set of bevel gears in figure 666.
 - d. Use a scale of 1" = 1".
 - e. Use correct drafting techniques.
 - f. Dimension the drawing correctly.
 - g. Also, include the cutting data block and all information.
 - h. If you have any difficulty see your instructor.

Just keep "gearing" along! Take your work to the instructor for an evaluation.

Remember the turtle: he doesn't get anywhere until he sticks his neck out.

DM-III-11

UNIT III: CAMS AND GEARS

TASK PACKAGE 11: LISTING TERMS USED IN WORM GEAR APPLICATIONS

PREREQUISITES: UNIT III, TASK PACKAGES 5-10

RATIONALE:

Do you do a lot of fishing? If you do, you probably use worms occasionally. This package is about worms - worm gears. The draftsman may find it beneficial to be able to understand the terminology related to worm gears. The worm gear provides power transmission and is found throughout industry. The draftsman needs to have a knowledge of the worm gear and its application. "Put a worm on the hook and let's fish out this Learning Activity."

OBJECTIVE:

Upon completion of this task package you will be able to list in writing, from an illustration, the terms used in worm gear application. Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

1. Read paragraphs 9 and 10, pages 589 and 590 in Engineering Drawing.

LEARNING ACTIVITY (cont'd):

2. Study pages 196 through 199 in Advanced Blue Print Reading, Volume II.
3. Notice the worm in figure 2 on page 199 in Advanced Blue Print Reading, Volume II. It looks a whole lot like an acme thread, doesn't it?
4. Look carefully at the different parts of the worm.
5. Notice the worm gear shown in figure 2. The gear in this illustration reminds you of a spur gear but with the ends having a concave effect.
6. Notice the gear in a worm gear set has more terms than the spur gear - terms such as "throat diameter" and "throat radius."
7. Figure 2 shows the relationship between the gear and the worm and represents a semi-conventional representation of a worm gear set.
8. If there are any questions, check with your instructor.
9. So, you've wormed your way through this Learning Activity. Very good. Now "wiggle" your way through the Learning Practice.

LEARNING PRACTICE:

DIRECTIONS: Read the entire Learning Activity before starting to work.

1. List the parts of the worm.
 - a. Study figure 2 on page 199 in Advanced Blue Print Reading.
 - b. On a sheet of ruled note paper, list the parts of the worm.

LEARNING PRACTICE (cont'd):

2. List the parts of the gear.
 - a. On a sheet of ruled paper, list the parts of the gear from figure 2.
3. Listing the dimensions of a worm and worm gear.
 - a. Study figures 10 and 11 on page 591 in Engineering Drawing.
 - b. List the following on a sheet of ruled note paper:
 1. throat diameter of the gear.
 2. face length of the worm.
 3. linear pitch of the worm.
 4. addendum of the gear.
 5. number of teeth of the gear.
 6. pitch diameter of the worm.
 7. outside diameter of the worm.
 8. face width of the gear.
 9. whole depth of teeth.
 10. pitch diameter of the gear.
 11. helix angle.
 12. pressure angle.
 13. throat radius.
 14. center distance between worm and gear.
4. Congratulations on a job well done. Take your answers to the instructor for an evaluation. Good work always brings home the Bacon.

DM-III-12

UNIT III: CAMS AND GEARS

TASK PACKAGE 12: DRAWING A WORM AND WORM GEAR

PREREQUISITES: UNIT III, TASK PACKAGES 1 - 11

RATIONALE:

At last the worm turns -- on a worm gear, that is. So turn your attention here to the worm gear, which is your last gear for this year.

The last gear you'll have to draw is the worm gear. As stated previously, this gear is used to transmit power. The draftsman needs to broaden his skills by mastering the technique of drawing the worm gear. This gear is related to the others we've discussed, but there are a few minor changes in terminology. However, after having successfully completed the other packages, you should breeze through this "wormy" package. Don't make any holes in it, though.

OBJECTIVE:

Upon completion of this task package you will be able to accurately construct a working drawing of a worm and worm gear. Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

1. Read paragraphs 9 and 10 on pages 589-590, in Engineering Drawing, by French and Vierck.
2. Study figures 10 and 11 on page 591 in Engineering Drawing.
3. What is the pitch diameter of the worm gear?

4. What is the number of teeth in the worm gear? _____
5. What is the pitch diameter of the worm? _____

6. What is the face length of the worm?

7. What is the pressure angle of the worm?

8. What is the face width of the worm gear?

LEARNING ACTIVITY (cont'd):

9. Do the worm gear and worm have the same axial pitch? _____
10. What is the addendum of the worm gear? _____
11. What is the outside diameter of the worm? _____
12. What is the addendum of the worm? _____
13. Have you wormed your way through this activity? Take your answers to the instructor.

LEARNING PRACTICE:

DIRECTIONS: Read the entire Learning Practice before starting to work.

1. Obtain two sheets of paper from the instructor.
2. Draw a worm gear.
 - a. Prepare your paper using layout "D."
 - b. Study figure 11 on page 591 in Engineering Drawing, by French and Vierck.
 - c. Draw the worm in figure 10, using a full scale.
 - d. Check with your instructor if you should have any difficulty.
 - e. Dimension the worm gear correctly.
 - f. Prepare a cutting data block for the worm gear, and list the information in the block.
3. Draw a worm.
 - a. Prepare your paper, using layout "D".
 - b. Study figure 10 on page 591 in Engineering Drawing.
 - c. Draw the worm in figure 10, using a full scale.

LEARNING PRACTICE (cont'd):

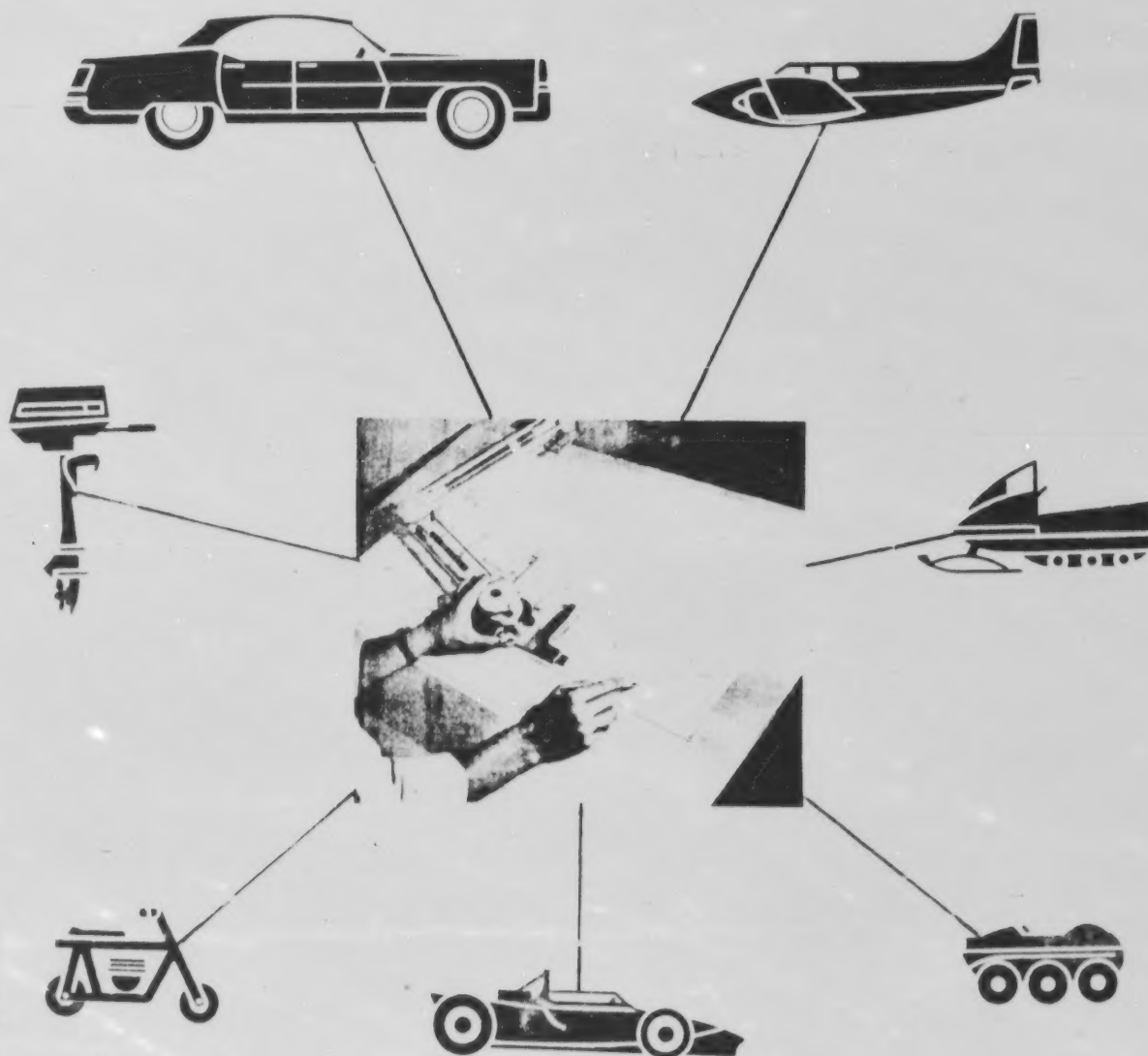
- d. Check with your instructor if you should have any difficulty.
- e. Dimension the worm correctly.
- f. Prepare a cutting data block for the worm, and list the information in the block.

Right on with a task package! You can take this work right on up to the instructor for an evaluation.

It takes creative individuals to master drafting skills the way you do.



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CE003933(d)

CLUSTER: DRAFTING
COURSE: BASIC TECHNICAL DRAFTING

DM-IV

UNIT PACKAGE IV: SURFACE DEVELOPMENTS

PREREQUISITE: UNIT I

RATIONALE:

Want to help create a development? You can draw one when you successfully complete this unit. These are surface developments. There are prisms and cylinders, pyramids and cones, and the construction of transition pieces all of which belong to the classification of surface developments.

The draftsman has to be able to develop cones, prisms, cylinders, and similar shapes in his duties. Create those shapes you see daily when you complete this unit on surface developments.

OBJECTIVE:

GENERAL:

Upon completion of this unit package you will be able to construct surface developments of cones, cylinders, prisms, pyramids and transition pieces by the triangulation method.

SPECIFIC:

Upon completion of the task packages for this unit you will be able to:

1. Construct a prism and cylinder by parallel-line method.

Your performance will be evaluated in accordance with the performance checklist.

OBJECTIVE (cont'd):

2. Construct a pyramid and cone by radial line development.
Your performance will be evaluated in accordance with the instructor's checklist.
3. Construct a transition piece by triangulation. Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

In order to complete this unit successfully you should begin your work on task package 1, and then as a suggestion, proceed to complete each task package in order, until you have finished each package in this unit. In the packages you will be asked to view a sound-slide presentation, read and answer questions, and perform some practical exercises. The number and names of the tasks included in this unit are as follows:

- TASK PACKAGE 1: CONSTRUCTION OF A PRISM AND CYLINDER BY RADIAL LINE DEVELOPMENT
- TASK PACKAGE 2: CONSTRUCTION OF A PYRAMID AND CONE USING RADIAL LINE DEVELOPMENT
- TASK PACKAGE 3: CONSTRUCTION OF A TRANSITION PIECE

If you should feel confident enough to pass a comprehensive test at this time, contact your instructor. However, should you feel you are not ready to be tested, begin your work as usual and

DM-IV-1

UNIT IV: SURFACE DEVELOPMENTS

TASK PACKAGE 1: CONSTRUCTION OF A PRISM AND CYLINDER BY PARALLEL LINE DEVELOPMENT

PREREQUISITES: UNIT I

RATIONALE:

Development doesn't apply only to the photo shop. There are different kinds of development, of course, and this task package deals with one type.

Do you want to learn about development? Sound interesting? A draftsman is called upon to do many things and design innumerable items. The development of any object consists of unfolding its surfaces so they lie in a flat plane. Most objects to be developed are shaped as a prism, pyramid, cylinder, cone, or a combination of these shapes. By means of development procedures, these shapes can be laid out accurately on a flat surface so the object can be folded to assume the correct shape. See what you can "develop" from this task package.

OBJECTIVE:

Upon completion of this task package you will be able to construct a prism and cylinder by parallel-line development. Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

1. Read sections 282-293 on pages 292-300 in Basic Technical Drawing.
2. Read sections 20.1 - 20.14 on pages 291-300 in Mechanical Drawing.
3. Review sound-slide presentation DM-IV-1 and Filmstrip FS 665622.
4. Study figure 20.5b on page 295. This figure shows you several of the different machines used to bend metal.
5. How many different classes of surfaces are there?

6. Study figure 612 on page 293 in Basic Technical Drawing.
7. What two objects are constructed using parallel-line development?

8. Define the word truncated.

9. Study figure 616 on page 295 in Basic Technical Drawing.
10. Notice how an auxiliary view was used to get the true length of some lines in figure 616.

LEARNING ACTIVITY (cont'd):

11. What is a stretchout line? _____

12. Study figure 617 on page 296 in Basic Technical Drawing.
13. Notice how the stretchout line is placed in this drawing.
14. What is an element? _____

15. Study figure 620 on page 298 in Basic Technical Drawing.
16. Notice how the circle and ellipse are divided. Look closely at the stretchout line in c.
17. What are the two types of cylinders? _____

18. Study figure 20.10 on page 299 in Mechanical Drawing.
19. How many parts was the cylinder divided into? _____

20. This is enough of the Learning Activity. Take your answers to the instructor.

LEARNING PRACTICE:

DIRECTIONS: Read the Learning Practice before you start
in work.

1. Obtain two sheets of paper from the instructor.

LEARNING PRACTICE (cont'd):

2. Draw two views of a truncated prism and a development using parallel-line development.
 - a. Prepare your paper using layout "D".
 - b. Study figure 642-1 on page 312 in Basic Technical Drawing.
 - c. Draw two orthographic views of the truncated prism as shown in figure 642-1, problem #1. Use full scale.
 - d. Dimension the orthographic views of the truncated prism correctly.
 - e. Develop the truncated prism drawn in figure 642-1, problem #1 using parallel-line development. Use full scale. Include the base and top of the prism in your development.
 - f. Have your instructor check your development.
 - g. After developing the prism, cut the prism out with a pair of scissors.
 - h. Put the prism development together, using tape or paste, whichever is provided by the instructor.
3. Draw two views of a truncated cylinder and a development using parallel-line development.
 - a. Prepare your paper using layout "D".
 - b. Study figure 642-1, problem #1 on page 312 in Basic Technical Drawing.

LEARNING PRACTICE (cont'd):

- c. Draw two orthographic views of the truncated cylinder as they are shown in figure 642-4, problem #1. Use full scale.
 - d. Dimension the orthographic views of the truncated cylinder correctly.
 - e. Develop the truncated cylinder in figure 642-4, problem #1, using parallel-line development. Use full scale. Do not include ends in your development.
 - f. Have your instructor check your development.
 - g. After developing the cylinder, cut the cylinder out with a pair of scissors.
 - h. Put the cylinder development together using tape or paste, whichever is provided by the instructor.
4. So, you've cut your way through this Learning Practice!!

Take your drawings and developments to your instructor so they can be evaluated.

Success in a play. From rehearsing.

DM-IV-2

UNIT IV: SURFACE DEVELOPMENTS

TASK PACKAGE 2: CONSTRUCTION OF A PYRAMID AND CONE USING RADIAL LINE DEVELOPMENT

PREREQUISITES: UNIT I; UNIT IV, TASK PACKAGE 1

RATIONALE:

The ancient Egyptians didn't sell ice-cream cones to the tourists who visited their pyramids. However, the present task package deals with cones and pyramids, though they may not be the types you're familiar with. So here's your chance to learn about the new kinds.

It is often necessary for the draftsman to make templates and full-size patterns for use in the layout of sheet material such as sheet metal. The principles involved in development drafting are the same throughout, regardless of the complexity of the object being developed. Therefore, it is necessary for the student to be well grounded in the basic fundamentals to become successful later as a development draftsman. Let's "home" in on the "cone" and give it the proper development.

OBJECTIVE:

Upon completion of this task package you will be able to construct a pyramid and cone by radial line development. Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

1. Read section 294 - 298 on pages 300 - 304 in Basic Technical Drawing.
2. Read sections 20.14 - 20.20 on pages 300 - 303 in Mechanical Drawing.
3. Review sound-slide presentation DM-IV-2.
4. Study figure 20.15 on page 301 in Mechanical Drawing.
5. Notice how the edge of the pyramid is rotated on the vertical axis and then measured as true length.
6. Study figure 20.17 on page 302 in Mechanical Drawing.
7. Study figures 20.19 and 20.20 on page 303 in Mechanical Drawing.
8. A cone is made up of an infinite number of what? _____
9. Study figures 20.21 and 20.22 on page 304 in Mechanical Drawing.

LEARNING ACTIVITY (cont'd):

10. What is the top tip of a pyramid called? _____
11. How do you construct a true-length line of a pyramid?

12. Study figures 626 and 627 on page 302 in Basic Technical Drawing.
13. Study figure 628 on page 303 in Basic Technical Drawing.
14. How do you find the number of degrees in the spread-out of the cone?

15. Have you developed an understanding of the Learning Activity?
Take your answers to the instructor.

LEARNING PRACTICE:

DIRECTIONS: Read the entire Learning Practice before starting to work.

1. Obtain two sheets of paper from your instructor.
2. Draw two views of a truncated pyramid and a development using radial-line development:
 - a. Prepare your paper using layout "P".
 - b. Study Figure 644-2, problem #1, on page 314 in Basic Technical Drawing.
 - c. Draw the orthographic views of the truncated pyramid that are shown in Figure 644-2. Use P-11 scales.
 - d. Develop the orthographic views of the truncated pyramid correctly.

LEARNING PRACTICE (cont'd):

- e. Develop the truncated pyramid drawn in figure 644-2, using radial line development. Use full scale. Follow the instructions given in the figure.
 - f. Have your instructor check your development.
 - g. After developing the pyramid, cut the pyramid out with a pair of scissors.
 - h. Assemble the pyramid development using tape or paste, whichever is provided by the instructor.
3. Draw two views of a truncated cone and a development using radial-line development.
 - a. Prepare your paper using layout "D".
 - b. Study figure 644-4, problem #1, on page 314 in Basic Technical Drawing.
 - c. Draw two orthographic views of the truncated cone as they are shown in figure 644-4. Use full scale.
 - d. Dimension the orthographic views of the truncated cone.
 - e. Develop the truncated cone as figure 644-4, problem #1, using radial-line development. Use full scale. Follow the instructions given in the figure.
 - f. Have your instructor check your development.

LEARNING PRACTICE (cont'd):

- g. After developing the cone, cut the cone out with a pair of scissors.
- h. Assemble the cone using tape or paste, whichever the instructor provides.

Take your work to the instructor for an evaluation. It looks as if you will reach the top tip of the drafting pyramid.

UNIT IV: SURFACE DEVELOPMENTS

TASK PACKAGE 3: CONSTRUCTION OF A TRANSITION PIECE

PREREQUISITES: UNIT I; UNIT IV, TASK PACKAGES 1 - 2

RATIONALE:

You don't have to be a square to convert "squares" to "rounds." In fact, you might be a little bit of a rounder and still learn the process.

The first two packages of this unit dealt with developing different geometric shapes. This package discusses how to convert "squares" to "rounds." Who said you could not put a square peg in a round hole? The draftsman uses this method frequently in the area of sheet metal and duct work. You need to transform the materials of this package into a useful sketch. A term used to identify the process here is triangulation. This means that you take a shape and a series of triangles to find the true length of the sides to develop them accurately. "Is your mind as inflexible as the material you provide enough transition to develop it."

OBJECTIVE:

Upon completion of this task package you will be able to construct a transition piece by triangulation. Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

1. Read sections 299 - 302 on pages 304 - 306 in Basic Technical Drawing.
2. Read sections 20.21 - 20.23 on pages 304 - 306 in Mechanical Drawing.
3. Review sound-slide presentation DM-IV-3.
4. Study figure 20.21 on page 304 in Mechanical Drawing.
5. Study figure 20.23a on page 305 in Mechanical Drawing.
6. Study figure 20.23b on page 306 in Mechanical Drawing.
7. Notice how the true length lines are projected.
8. The process of developing from a square to a circle is the process of placing of a geometric figure side by side?
9. Study figure 6.12 on page 305 in Basic Technical Drawing.
10. In picture 6.12, what does the letter S mean?

LEARNING ACTIVITY (cont'd):

11. What is a transition piece? _____

12. Have you gone from "squares" to "rounds" in this Learning Activity? If so, take your answers to your instructor.

LEARNING PRACTICE:

DIRECTIONS: Read the entire Learning Practice before starting to work.

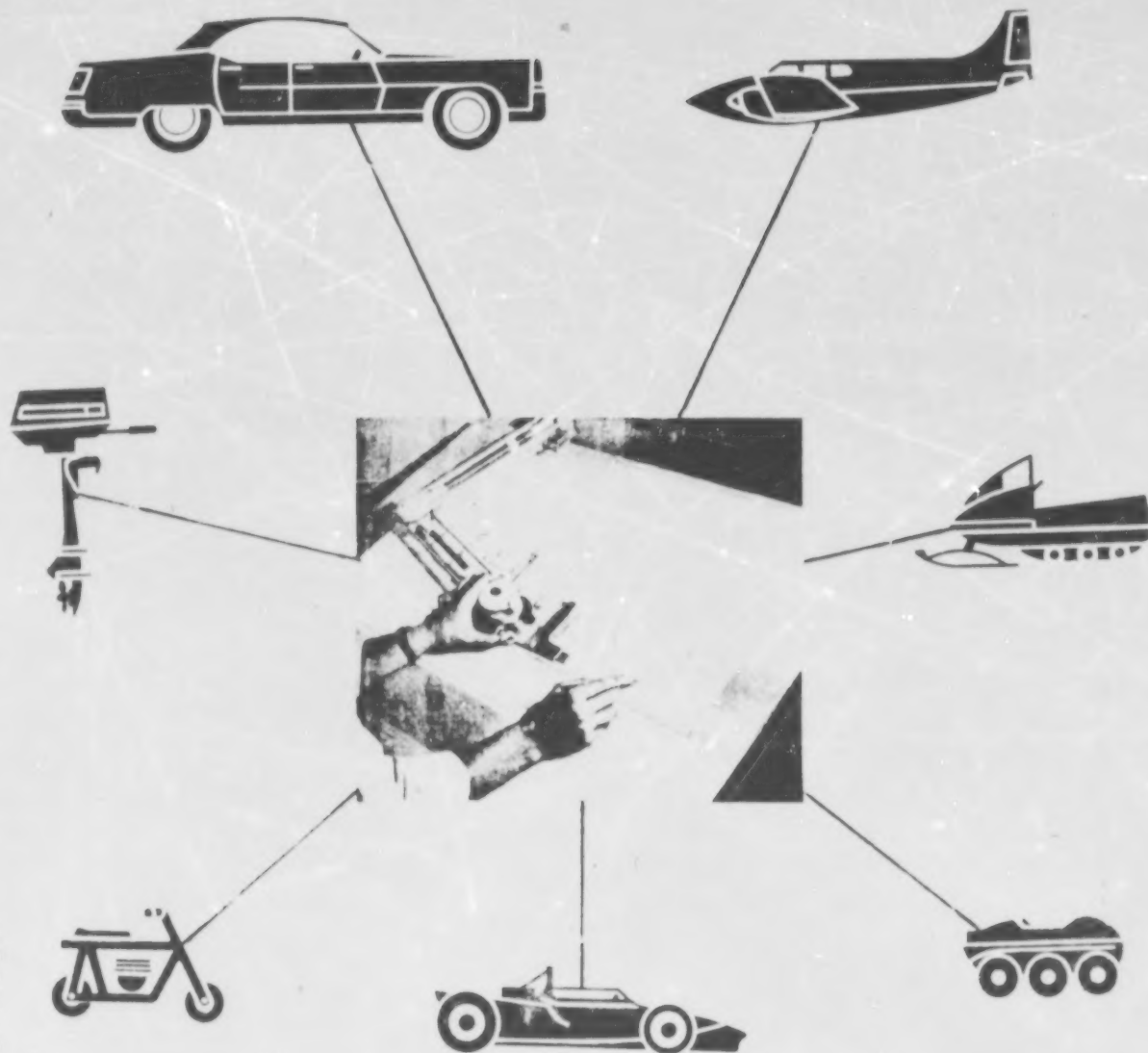
1. Obtain two sheets of paper from your instructor.
2. Draw a transition piece from square to round.
 - a. Prepare your paper using layout "D".
 - b. Study figure 645-2 on page 315 in Basic Technical Drawing.
 - c. Draw two orthographic views of the transition piece just as they are shown in figure 645-2. Use a full scale.
 - d. Dimension the orthographic views correctly.
 - e. Develop the transition piece using the triangulation method. Employ full scale.
 - f. Have your instructor check your transition piece.
 - g. After developing the transition, cut the development out with a pair of scissors.
 - h. Assemble the transition piece using tape or paste, following the instructor's direction.
3. Draw a transition (four-view) problem.

LEARNING PRACTICE (cont'd):

- a. Prepare your paper using layout "D".
 - b. Study figure 647-11 on page 317 in Basic Technical Drawing.
 - c. Draw two orthographic views of the transition piece as shown in figure 647-11. Use a full scale.
 - d. Dimension the orthographic views of the transition piece correctly.
 - e. Develop the transition for the transition piece using the triangulation method. Employ a full scale.
 - f. Have the instructor check your transition.
 - g. After developing the transition, cut the transition out with a pair of scissors.
 - h. Assemble the transition using tape or paste, whichever the instructor supplies.
4. You have "transformed" the Learning Practice. Take your work to the instructor for an evaluation.
- You're really coming round to learning how drawing skills apply.



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CE003933 (e)

CLUSTER: DRAFTING
COURSE: BASIC TECHNICAL DRAFTING

DM-V

UNIT PACKAGE V: DRAWING BAR, LINE AND PIE CHARTS

PREREQUISITES: NONE

RATIONALE:

The charts say the number one package of this unit is bar, line and pie charts. How's that for a switch? Every draftsman needs to know how to construct charts and graphs. Each chart can give a specific type of information so the draftsman needs to be familiar with those in this unit. So settle down and get yourself a piece of this action by completing the Objective in this unit.

OBJECTIVE:

GENERAL:

Upon completion of this task package you will be able to draw, from given information, bar, line and pie charts.

SPECIFIC:

Upon completion of the task package for this unit, you will be able to:

1. Construct, from data provided by your instructor, the following charts:
 - a. line or curve chart.
 - b. bar chart.
 - c. pie chart.

OBJECTIVE (cont'd):

You will use correct drafting techniques, and your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

This unit has one task package. In this package you will be asked to view a sound-slide presentation, read and answer questions, and perform some practical exercises. The number and name of the task package included in this unit are as follows:

TASK PACKAGE 1: DRAWING A BAR, LINE AND PIE CHART

If you should feel confident enough to pass a comprehensive test at this time, contact your instructor. However, should you feel you are not ready to be tested, begin your work as outlined

01-V-1

UNIT V: CHARTS

TASK 1: PAGE 1: DRAWING BAR, LINE AND PIE CHARTS

PREREQUISITES: NONE

RATIONALE:

You may find this package as easy as pie - as a pie chart, that is. Now, chart your course to new drafting techniques of great value.

The draft^gman may be called upon to make graphical comparisons related to industry. He should have a working knowledge in being able to construct line, bar and pie charts. Also he should know which one to select that will best represent the given data. The three basic charts this package presents will help give you a better understanding of the use of charts in industry. Charts present information in a manner that is easy to understand. Information is made clear through the use of charts. You will find yourself up at a moment's notice, ready to draw the next chart of success.

OBJECTIVE:

Upon completion of this task package you will be able to construct, from given data, the following charts:

- a. line or curve chart.
- b. bar chart.
- c. pie chart.

Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

1. Read pages 318 - 321 in Basic Technical Drawing.
 24.5 and 24.6 on pages 383 and 384,
 and 24.7 and 24.8 on pages 385 - 386 in Basic Technical Drawing.
2. Review sounder/echo presentation of 1-1.
3. Study figure 24.2a and 24.2b in Basic Technical Drawing.
Drawing.
4. Note carefully the different types of line used in drawing.
5. Study figure 24.3a and 24.3b in Basic Technical Drawing. This is a curved chart.
6. Study figure 24.9a on page 385 in Basic Technical Drawing. This represents a bar chart.
7. Study figure 24.1a on page 386 in Basic Technical Drawing. This represents a pie chart.

LEARNING ACTIVITY (cont'd):

9. What is the percentage of thermal radiation in Figure 24.10?

10. Study figures 648 and 649 on page 11A in Basic Technical Drawing.

11. What is a bar chart? _____

12. In figure 648, what is the population of Philadelphia?

13. What are line charts used for? _____

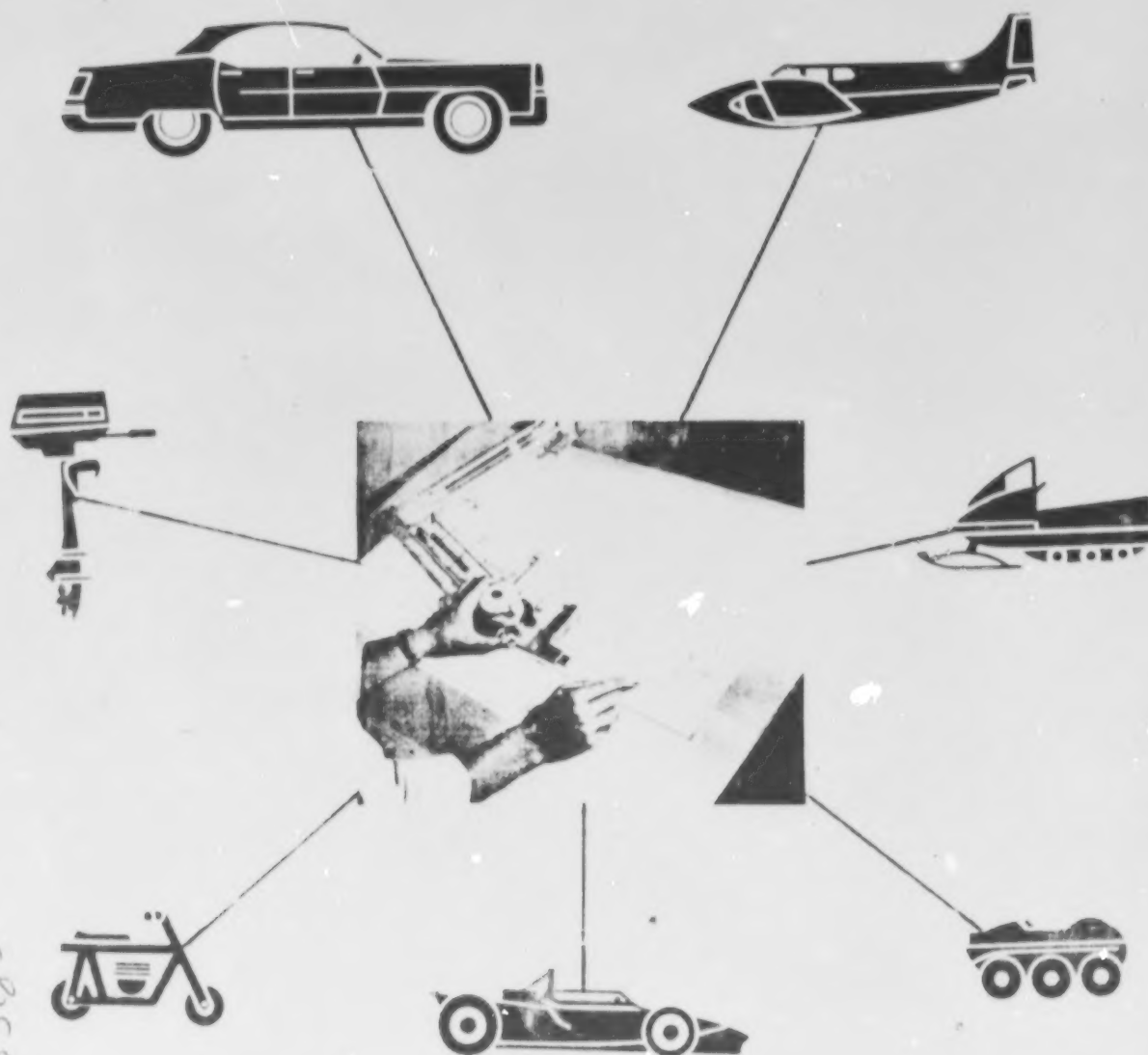
14. Study figure 653 on page 329 in Basic Technical Drawing.
Figure 653: How many scientists were on atomic energy projects in 1954?

15. Study figure 654 on page 330 in Basic Technical Drawing.

16. What percent of scientists in 1954 were on atomic energy projects?
In Figure 654? _____
17. What percent of scientists in 1954 were on atomic energy projects?
In Figure 654? _____
18. What percent of scientists in 1954 were on atomic energy projects?
In Figure 654? _____
19. In figure 655a, what percent of the total scientists were on atomic energy projects?
From excise taxes? _____



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CLUSTER: DRAFTING
COURSE: BASIC TECHNICAL DRAFTING

DM-VI

UNIT PACKAGE VI: WORKING DRAWINGS AND SHOP PROCESSES

PREREQUISITES: UNITS I-III

RATIONALE:

You now have several skills related to mechanical drafting. This last unit will give you an opportunity to develop new skills to build to those you already have.

The draftsman draws working drawings - these are the drawings used to produce objects in industry. These working drawings can be simple, or very difficult. Within the realm of working drawings are also shop processes - how are some of the operations performed in the machine shop, and how does the material flow?

Complete this unit and you will have completed the course.

OBJECTIVE:

GENERAL:

Upon completion of this unit package you will be able to draw detail and assembly drawings and have a knowledge of the operations and work flow performed in the machine shop.

OBJECTIVE (cont'd):SPECIFIC:

Upon completion of the task packages for this unit, you will be able to:

1. Draw a simple detailed working drawing. Your performance will be evaluated in accordance with the instructor's checklist.
2. Draw a simple assembly working drawing. Your performance will be evaluated in accordance with the instructor's checklist.
3. Describe in writing the applications of basic shop processes in manufacturing a part using the following:
 - a. three stages of part production.
 - b. sand casting.
 - c. ~~foundry~~
 - d. welding.
 - e. die casting.

Your performance will be evaluated in accordance with the instructor's checklist.

4. List in writing the following:
 - a. five operations performed on the drill press.
 - b. four operations performed on the lathe.
 - c. six operations performed on the milling machine.

Your performance will be evaluated in accordance with the instructor's checklist.

OBJECTIVE (cont'd):

5. Draw a machine shop layout to scale and show the flow of work within the shop. Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

In order to complete this unit successfully, you should begin your work on Task Package 1, and then as a suggestion, proceed to complete each task package in order, until you have finished each package in this unit. In the packages you will be asked to view a sound-slide presentation, read and answer questions, and perform some practical exercises. The number and names of the task packages included in this unit are as follows:

TASK PACKAGE 1: DRAWING A SIMPLE DETAIL DRAWING.

TASK PACKAGE 2: DRAWING A SIMPLE ASSEMBLY WORKING DRAWING WITH TITLE STRIP AND PARTS LIST.

TASK PACKAGE 3: DESCRIBING SHOP PROCESSES.

TASK PACKAGE 4: LISTING BASIC OPERATIONS ON THE LATHE, DRILL PRESS AND MILLING MACHINE.

TASK PACKAGE 5: WORK FLOW IN A MACHINE SHOP.

If you should feel confident enough to pass a comprehensive test at this time, contact your instructor. However, should you feel you are not ready to be tested, begin your work as outlined above.

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OBJECTIVE:

Upon completion of this task package you will be able to draw a simple detailed working drawing. Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

1. Read sections 2.15 - 2.27 on pages 215 - 225 in Basic Technical Drawing.
2. Read sections 13.1 - 13.5 on pages 172 - 177 in Mechanical Drawing.
3. What is a working drawing?

5. Study figure 13.6 on page 174 in Mechanical Drawing.
6. What two views of the object are shown?

7. Study figure 7.10 on page 114 in Basic Technical Drawing.
8. What types of views are shown in figure 7.10?

9. What part number is shown in figure 7.10?

10. Study figure 7.11 on page 115 in Basic Technical Drawing.
11. What is the name of the object shown in figure 7.11?

LEARNING ACTIVITY (cont'd):

12. What is the total length of the arm adjusting shaft? _____
13. How many parts are on the working drawing in figure 310? _____
14. Name the parts in figure 310. _____

15. Notice in figure 310 that information is provided for all parts.
If the part is not to be made, but is to be furnished by someone,
it is noted as such. _____
16. What is the pressure angle of the gear on the arm adjusting shaft
sleeve? _____
17. Have you "worked" your way through another Learning Activity?
Good! Take your answers to the Instructor.

DIRECTIONS: Read the instructions carefully and follow them.

1. Obtain three sheets of drawing paper and a pencil.
2. Draw a circle 100 mm in diameter.
 - a. Prepare your paper as indicated.
 - b. Study problem 1 in figure 310.
 - c. Draw the gear on the circle as shown in figure 310.
3. Draw the gear on the circle as shown in figure 310.
4. Dimension the gear as shown in figure 310.

LEARNING PRACTICE (cont'd):

3. Draw a working drawing of the double bearing.
 - a. Prepare your paper using layout "E".
 - b. Study problem 13.5 on page 483 in Mechanical Drawing.
 - c. Construct a working drawing of the double bearing using three views. Use a full scale.
 - d. Dimension the double bearing using the correct techniques.
4. Draw a working drawing of the support.
 - a. Prepare your paper using layout "E".
 - b. Study problem 13.6 on page 483 in Mechanical Drawing.
 - c. Construct a working drawing of the support following the directions listed on page 483.
 - d. Dimension the support using the correct technique.
5. "Keep your back and head right lines with pen in hand and a happy thought." Take your work to the instructor for an evaluation.

From here, it looks as if you're drawing better & easier in drafting.

DM-VI-2

UNIT VI: WORKING DRAWINGS AND SHOP PROCESSES

TASK PACKAGE 2: DRAWING A SIMPLE ASSEMBLY WORKING DRAWING WITH
TITLE STRIP AND PARTS LIST

PREREQUISITES: UNITS I, II, III; UNIT VI, TASK PACKAGE 1

RATIONALE:

Draw all your attention to a focus on the assembly drawing, and assemble all your drawing powers for this package. Assembly drawing is very important to the draftsman.

The assembly drawing includes all the parts of an item assembled. Parts of the object may be sectioned for clarification, and the object, is fully dimensioned. The draftsman needs to know how to draw an assembly drawing so that he can convey his ideas and drawings in understanding his ideas. The workman can get a working picture of all the objects assembled in one package and the relationship of the parts to the whole. "Assembly drawing is the language of the draftsman."

OBJECTIVE:

Upon completion of this task package, you will be able to draw a simple assembly working drawing of a part. Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

1. Read sections 240-247 on pages 235-241 in Basic Technical Drawing.
2. Read sections 13.5-13.11 on pages 177-186 in Mechanical Drawing.
3. What does an assembly drawing show? _____

4. What does a general assembly show? _____

5. What does a working drawing assembly show? _____

6. What is a parts list? _____
7. Study figure 522 on page 239 in Basic Technical Drawing.
8. Which symbol is used for general purposes? _____
9. _____
10. How many parts does the first right-hand view show? _____
11. Study figure 11.10 on page 147 in Mechanical Drawing.
12. Notice carefully the different views of the object shown.
13. Study figure 13.11 on page 181 in Mechanical Drawing.
14. How many parts are shown in figure 13.11? _____
15. How many parts are shown in figure 13.11? _____
16. Study figure 11.8 on page 144. This shows the correct layout of views on the paper.
17. Study figure 11.30 on page 141 in Mechanical Drawing.
18. What's the part number of the "B" part? _____
19. Breexing along!!

LEARNING PRACTICE:

DIRECTIONS: Read the entire Learning Practice before starting to work.

1. Obtain two sheets of paper from the instructor.
2. Draw a general assembly working drawing of problem 13.58.
 - a. Prepare your paper using layout "F".
 - b. Study problem 13.58 on page 497 in Mechanical Drawing.
 - c. Construct a general assembly working drawing of problem 13.58. Draw two views using a full scale.
 - d. Prepare a parts list for your working drawing. Incorporate the parts list on the drawing.
3. Draw a working-drawing assembly of a fig.
 - a. Study problem 13.59 on page 497 in Mechanical Drawing.
 - b. Construct a working-drawing assembly of the fig. Draw three views, using a full scale.
 - c. Prepare a parts list for your assembly drawing. Label the parts of the fig. Incorporate the parts list on the assembly drawing.
 - d. Dimension all views of the assembly drawing.

A task package is your assignment. Your assignment is to complete the task for an evaluation.

You're really assembling a fine time at a work station.

DM-VI-3

UNIT VI: WORKING DRAWINGS AND SHOP PROCESSES

TASK PACKAGE 3: DESCRIBING SHOP PROCESSES

PREREQUISITES: UNITS I, II, III; UNIT VI, TASK PACKAGES 1 - 2

RATIONALE:

The draftsman, in order to understand some of his drafting techniques, has to be able to understand some of the shop processes performed in the machine shop. With a clearer idea of how a part is manufactured, the draftsman can relate more fully his concept of how the idea or object should be illustrated. Knowing the shop processes will give the draftsman a keener insight into the types and potential uses of materials. "So let's shop around. Who knows? You may find some values in knowledge."

OBJECTIVE:

Upon completion of this task package you will be able to describe in writing the applications of basic shop processes in manufacturing a part using the following:

- a. three stages of part production.
- b. sand casting.
- c. forging.
- d. welding.
- e. die casting.

Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

1. Read sections 248-257 in your textbook on Sand Casting.
2. Study figure 319 on page 256 of your textbook.
3. Notice the sprig pattern in the center of figure 319. If you look carefully at the top of the sprig, you will see a core pointing to the core print. When the pattern has been used in the sand, a core is used to fill the holes.
4. Look at the illustration of sand casting on page 257 of your textbook.
5. Study figure 320 on page 257 of your textbook. Notice the two parts of the flask: the cope and the drag.

LEARNING ACTIVITY (cont'd):

6. Note where the core fits in the sand.
7. Study figure 321 on page 147 in Basic Technical Drawing.
8. Study figure 322 on page 148 in Basic Technical Drawing.

After studying the examples of runouts, do you notice how the orthographic views make sense as to how the runouts are applied?

9. Study figure 327 on page 150 in Basic Technical Drawing. These illustrations represent the basic forms of stock forms.
10. Have you shopped through this Learning Activity? If so, "process" the Learning Practice.

LEARNING PRACTICE:

DIRECTIONS: Read the entire Learning Practice before starting

1. Answer the following questions as they apply to the machine shop:
 - a. List the three stages of metal production that are used in the machine shop.
 - b. Describe in writing the process of casting as it applies to the production of metal in the machine shop.
 - c. Describe in writing the process of forging as it applies to the production of metal in the machine shop.
 - d. Describe in writing the process of machining as it applies to the production of metal in the machine shop.
 - e. Describe in writing the process of welding as it applies to the production of metal in the machine shop.

You're hanging in there! Good job! You've completed the Learning Practice.

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OBJECTIVE:

Upon completion of this task package you will be able to list the following:

- a. four operations performed on the lathe.
- b. six operations performed on the milling machine.
- c. five operations performed on the drill press.

Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

1. Read sections 158-166 on pages 153-147 in Basic Technical Drawing.
2. Review sections 158-166 on pages 153-147 in Basic Technical Drawing.
3. Study figure 329 on page 147 in Basic Technical Drawing.
4. Figure 329 illustrates the use of the machine tool in the machine shop. The machine tool is a device used to shape and have precision work done on metal.
5. Study figure 329 on page 147 in Basic Technical Drawing.
6. Observe carefully the use of the machine tool in the machine shop. If you have any questions, perhaps you will want to ask the instructor. He may arrange for you to see the machine tool in operation.

LEARNING ACTIVITY (cont'd):

7. Study figure 338 on page 155 in Basic Technical Drawing.
8. Notice how these different tools help represent a particular operation that can be performed on the drill press.
9. Study figure 341 on page 156 in Basic Technical Drawing.
10. Notice all these operations that are performed on the milling machine. Did you know that the milling machine was such a versatile machine?
11. Study figure 343 on page 157 in Basic Technical Drawing.
This is the process where you can make square holes from round holes, or, in the case demonstrated in figure 343, a round hole to a hex hole.

Could you have waited until this point to give you a tour of the machine shop.

LEARNING PRACTICE:

DIRECTIONS: Read the entire Learning Practice before starting to work.

1. List in writing the following:
 - a. Four operations that are performed on the lathe in reference to the production of parts.
 - b. Six operations that are performed on the milling machine in reference to the production of parts.
 - c. Five operations that are performed on the drill press in

LEARNING PRACTICE (cont'd):

reference to the production of parts.

2. What are the two processes that follow the drilling operation?
3. What is the difference between spot facing, counterboring and countersinking?
4. How are objects affixed to the milling machine?

Would you drive a block for a task package? Well, you've driven the block for this one. Take your answers to the instructor for an evaluation.

You're really making the scene with these machines.

DM-VI-5

UNIT VI: WORKING DRAWINGS AND SHOP PROCESSES

TASK PACKAGE 5: WORK FLOW IN A MACHINE SHOP

PREREQUISITES: UNITS I, II, III; UNIT VI, TASK PACKAGES 1-4

RATIONALE:

Let your thoughts flow smoothly here in your study of work-flow in a machine shop. Are you ready? Then chart the flow of your thoughts and do this assignment with ease.

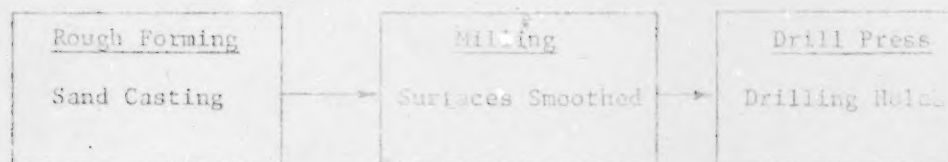
As stated before, the draftsman has to have a knowledge of the processes performed in the machine shop. He may need to have information of this type when drawing a part or representing an idea. The draftsman needs to know the relationship between a finished product and the operation that created the finished product. "Gather your thoughts and let's flow through this task package." The successful graphical representation of a drawing depends on your processes.

OBJECTIVE:

Upon completion of this task package you will be able to draw a machine-shop layout to scale, and show, using a flow chart, the flow of work within the shop. Your performance will be evaluated in accordance with the instructor's checklist.

LEARNING ACTIVITY:

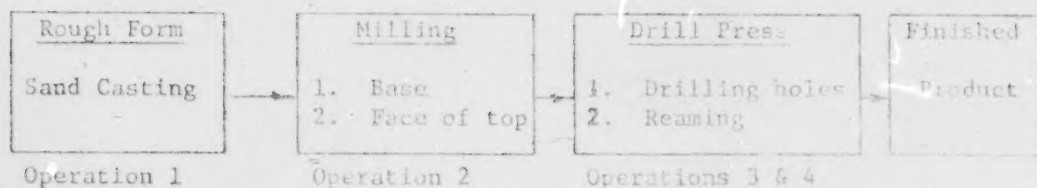
1. Study figure 506 on page 227 in Basic Technical Drawing.
2. This figure represents a flow chart used in the routing of drawings. You will be required to draw a simple flow chart to be used in the successful completion of this task package. Your chart will be very simple, composed of blocks 1" in length and 1/2" high. Within these blocks will be printed the type of machine and operation performed on that machine. See the example below:



Of course these are just a few of the operations that could be performed on the machines in a shop. You will include all the operations and end up with a finished product.

LEARNING ACTIVITY (cont'd):

3. Review chapter 10 in Basic Technical Drawing.
4. We will now do a flow-of-work problem.
5. Study figure 344 on page 158 in Basic Technical Drawing.
6. Observing carefully, we note that this object is made of cast iron. Therefore, the rough forming process is (1) sand casting. This is our first block for the flow chart.
7. We notice the two holes drilled into the base. We assume the part is to be bolted to another part so the bottom of the base should be level. This is another operation - (2) milling. Also notice the face of the hole toward the top of the part. This part was milled also.
8. We drill the holes in the base and the top part (3), then we ream (4) the large hole to size.
9. This now constitutes a finished product, a shaft bracket.
10. We have our operations and know where these were performed; let's chart this information.
- 11.



LEARNING ACTIVITY (cont'd):

12. Now, did that seem hard? Of course, it didn't. You saw how the information just "flowed." Check with your instructor; he may want to ask you about the flow of work.

LEARNING PRACTICE:

DIRECTIONS: Read the entire Learning Practice before starting to work.

1. Obtain two sheets of paper from your instructor.
2. Draw a flow of work chart for figure 345 on page 158 in Basic Technical Drawing.
 - a. Prepare your paper using layout "C".
 - b. Study figure 345 on page 158 in Basic Technical Drawing.
 - c. Determine the operations performed on figure 345.
 - d. Draw a flow of work chart for figure 345.
 - e. Label the chart correctly.
3. Draw a flow of work chart for figure 348 on page 158 in Basic Technical Drawing.
 - a. Prepare your paper using layout "C".
 - b. Study figure 348 on page 158 in Basic Technical Drawing.
 - c. Determine the operations performed on figure 348.
 - d. Draw a flow of work chart for figure 348.
 - e. Label the chart correctly.
 - f. Take the information found above and trace the flow of work of the machine shop layout you did in part two of this Learning Practice.

LEARNING PRACTICE (cont'd):

"Nothing to it, but to do it, and you've done it." Take your work to the instructor for an evaluation.

This is the last package in the "Mechanical Drafting" course. It is hoped that you have succeeded in all that you have attempted. You have found that the prime ingredient of these task packages was not necessarily the written material, but you. There could have been no successful completion of these objectives without your desire to reach them. Congratulations and remember - you're flowing right along to a creative career in drafting.

Nothing is too big to accomplish in this world if you break it down to bite size. When you digest knowledge bite by bite, you will see that you digest it better and longer. Thank you.

"Because you have been successful, you have made us successful."